National Aeronautics and Space Administration

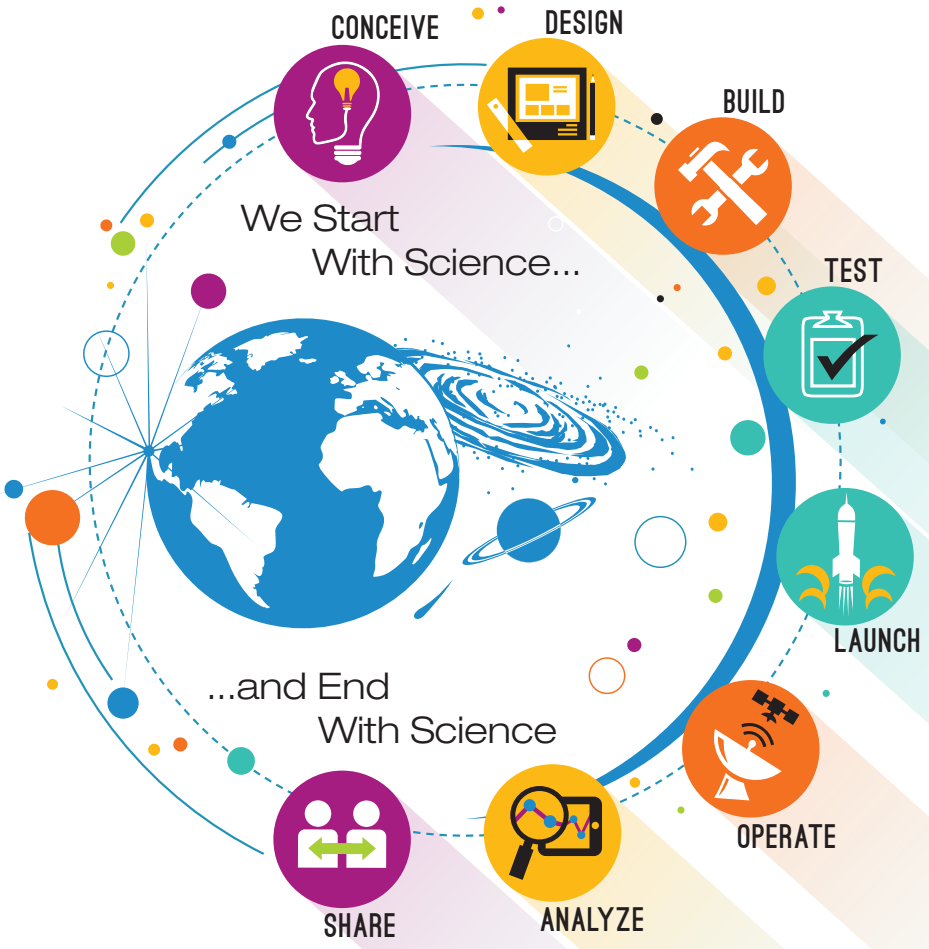
2015

GODDARD SPACE FLIGHT CENTER

ANNUAL REPORT

www.nasa.gov

THE GODDARD PROJECT LIFE CYCLE



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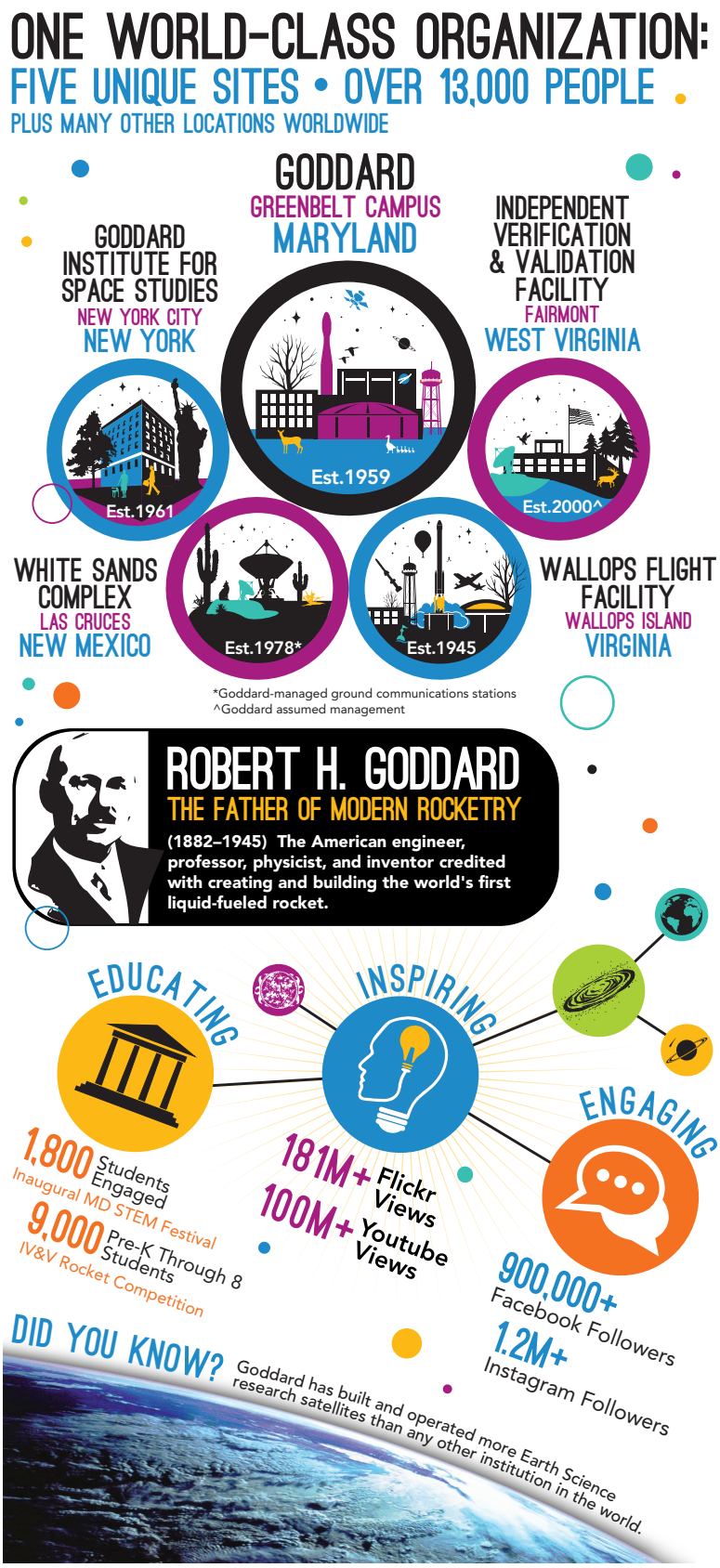
On Earth Day, April 22, 2015, NASA asked: What is your favorite place on Earth? Submissions came from all 50 U.S. states and 145+ countries and territories. These images were all shared on social media.

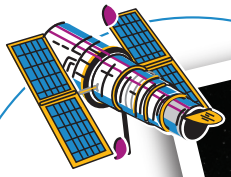
There is truly no place like home.

GLOBAL PROVIDER OF SCIENTIFIC RESEARCH, TECHNOLOGY, AND MISSIONS THAT TRANSFORM OUR KNOWLEDGE OF EARTH AND SPACE

Expert in the study of our world, the solar system, and beyond, NASA Goddard Space Flight Center (GSFC) has been working since 1959 to increase scientific understanding, answer humanity's big questions, and benefit the society and communities we serve. The center's work in science, engineering, technology, and communications strengthens our ability to envision the origins of life, preserve our way of living, and define our place in the universe. We identify requirements and innovations; design, build and launch spacecraft; and manage and support entire space missions. Our fundamental communications infrastructure enables NASA and others to bring back knowledge from space, share it with diverse customers, and apply it to society in countless ways.



Goddard AT A GLANCE

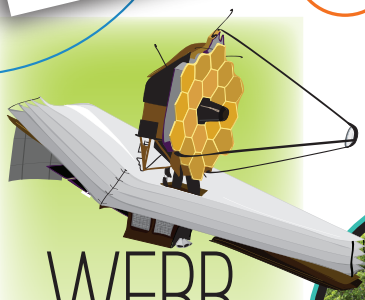


100
TERABYTES OF DATA PROVIDED BY HUBBLE

37,000+
LIVES SAVED
WORLDWIDE THROUGH GODDARD-ENABLED SEARCH & RESCUE

1976
Greenbelt Visitor Center Opened! 150,000+ visitors since 2012

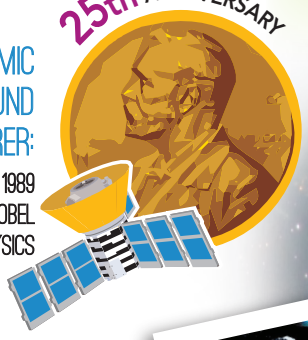
3,000
COMETS DISCOVERED BY SOHO



WEBB
will be a powerful time machine with infrared vision that will peer back over **13.5** billion years.

1 of **63** known living Moon Trees planted from approximately **450** seeds taken on the Apollo 14 mission

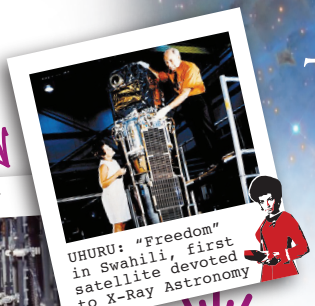
25th ANNIVERSARY

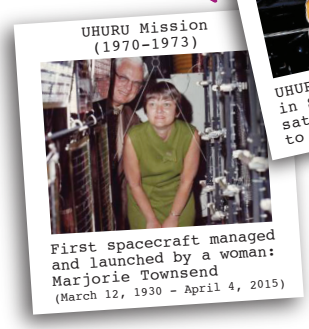


COSMIC BACKGROUND EXPLORER:
LAUNCHED IN 1989
LED TO A NOBEL PRIZE IN PHYSICS

1 PRIMETIME EMMY AWARD
NATIONAL ACADEMY OF TELEVISION ARTS & SCIENCES
FIRST LIVE TV BROADCAST FROM THE MOON IN 1969

GODDARD'S "FIRSTS"





40+ Years of Experience Managing the Development of NOAA's Weather Satellites

NATIONAL INVENTORS HALL OF FAME
2015: George E. Alcorn
X-ray Imaging Spectrometer

www.nasa.gov/goddard

OUR LEGACY

NASA VISION

We reach for new heights and reveal the unknown for the benefit of humankind.

NASA MISSION

Drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth.

NASA'S STRATEGIC GOALS

1. Expand the frontiers of knowledge, capability, and opportunity in space.
2. Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.
3. Serve the American public and accomplish our mission by effectively managing our people, technical capabilities, and infrastructure.

A PLACE FOR SCIENCE

For the good of our Nation and the world, Goddard leads scientific research and exploration that transforms our understanding of Earth and space and enhances the lives of people on our home planet.

We advance NASA's mission by leading scientific research, and by building, launching, and operating scientific instruments, spacecraft, and information systems. As a science center, Goddard seeks to understand the Earth and to explore the universe through a robust program of scientific research in Earth science, astrophysics, heliophysics, and planetary science. As a spaceflight center, Goddard utilizes its core technical and programmatic expertise and facility capabilities to execute a broad range of flight missions and field campaigns. We are committed to enabling innovation and developing new technologies that expand the agency's technical capabilities in support of its overarching mission. Goddard then applies its breakthroughs to society: stimulating economic growth, fostering the education of the next generation, and inspiring the Nation.

CENTER DIRECTOR'S MESSAGE

For more than 50 years, NASA's Goddard Space Flight Center has laid a foundation of scientific and technical knowledge that society will apply to its endeavors today and in the future. I am inspired by, and grateful for, the exceptional legacy that forms the backbone of our work. Since its establishment in 1959 as the agency's first spaceflight center, Goddard has been a leader in advancing our understanding of astrophysics, Earth science, heliophysics, planetary science, and engineering and technology.

This past year, we celebrated milestones for missions that have made—and continue to make—countless discoveries in our quest to understand Earth, our solar system and worlds beyond. All the while, we have remained hard at work developing future missions that will carry our legacy for generations to come.

In 2015, we celebrated the 25th launch anniversary of the Hubble Space Telescope. Similarly, Goddard's Wallops Flight Facility, a leader in research and technology since 1945, marked 70 years in June. Goddard held open houses in commemoration of these anniversaries at both Wallops and Greenbelt with an extraordinary turnout for both events—evidence of the public's overwhelming appreciation for our work and the people who make it all happen.

During the year, we added the Soil Moisture Active Passive spacecraft to our constellation of Earth-monitoring sentinels and gained new insights into the climate system with the Global Precipitation Measurement mission's first global map of rainfall and snowfall.

We launched two new missions in 2015—the Magnetospheric Multiscale mission and NOAA's Deep Space Climate Observatory—while two other heliophysics missions celebrated their 5th and 20th anniversaries. The Solar Dynamics Observatory studied a sunspot 80,000 miles wide, the largest yet of the current solar cycle; and the Solar and Heliospheric Observatory spotted its 3,000th comet.

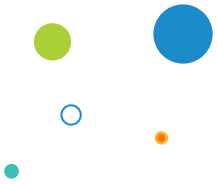
As NASA moves forward with its Journey to Mars, Goddard continues to research the Red Planet as part of the agency's goal to send humans to Mars by the 2030s. The Sample Analysis at Mars instrument suite detected organic matter on the planet's surface while the Mars Atmosphere and Volatile Evolution mission made landmark discoveries about the upper atmosphere.

I invite you to explore this annual report and learn about these and many of our other notable achievements from the past year. With our breadth of work across an extensive portfolio of science disciplines, it is impossible to include them all. Please visit our website, *www.nasa.gov/goddard*, for greater detail regarding our efforts and accomplishments.

As 2016 begins in earnest, we can look forward to a year that will produce the next generation of missions and technologies that will further advance our scientific capabilities. We plan to launch such missions as Astro-H, Raven, OSIRIS-REx, GOES-R, JPSS-1, NICER, and ISS-CREAM, and we will continue progress on important projects in support of science and human spaceflight.

The challenges ahead of us are extraordinary, and we remain extremely proud to do the work that we do. I am privileged to be part of a group of immensely talented and committed individuals who continue to push the boundaries of what is possible in the universe.

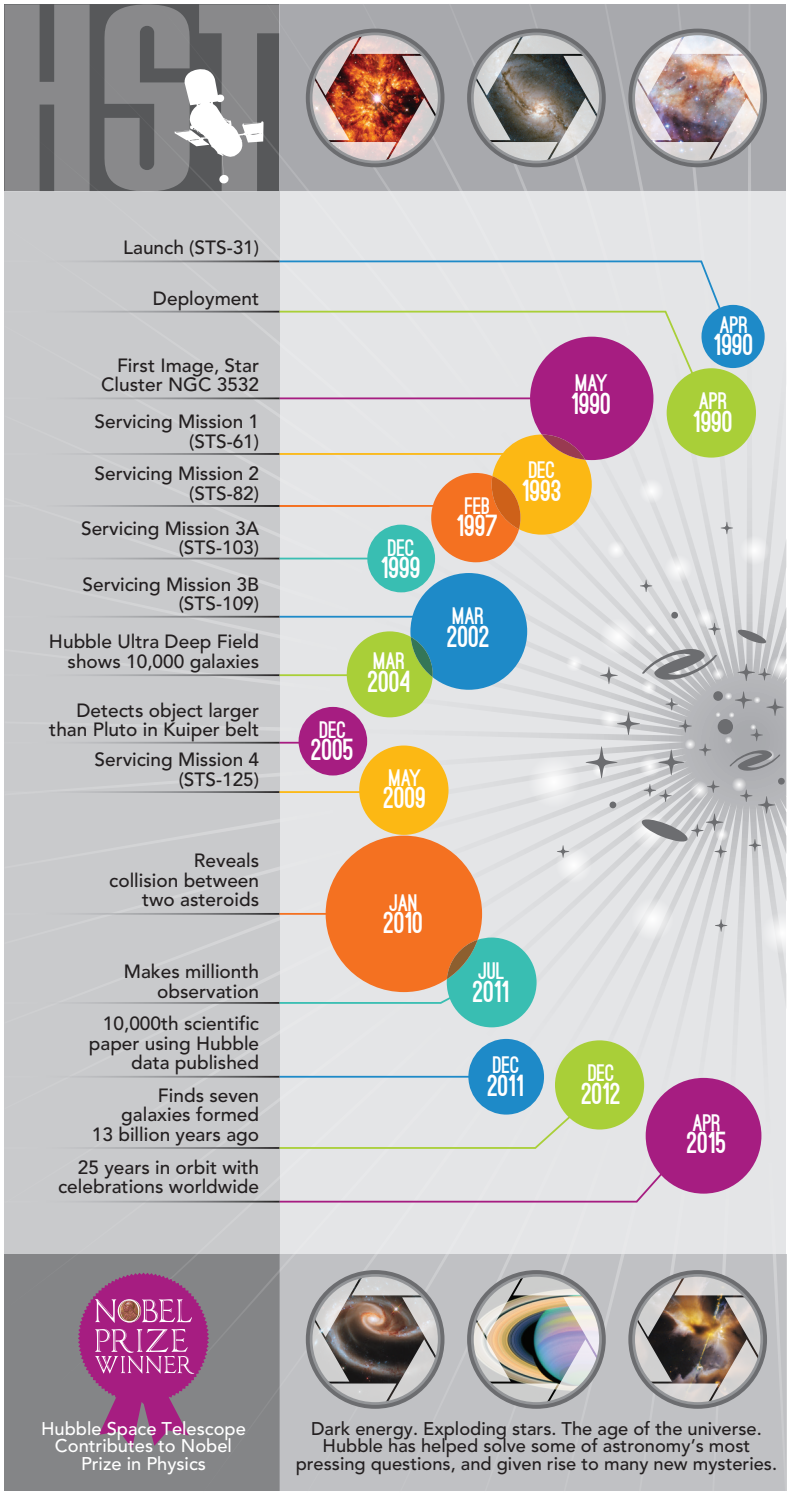
Chris Scolese
Center Director



25 YEARS OF HUBBLE'S UNIVERSE

Launched in 1990, the Hubble Space Telescope has made over 1.2 million observations of more than 38,000 celestial objects.

- The world's first large, space-based optical telescope was named after American astronomer Edwin P. Hubble (1889-1953). Dr. Hubble confirmed an "expanding" universe, which provided the foundation for the Big Bang theory.
- In its 25-year lifetime, the telescope has made nearly 137,000 trips around our planet. Hubble's miles traveled, 3.4 billion, is nearly the average distance from Pluto to the Sun.
- An average of 829 gigabytes of Hubble data are added to the archive every month. Hubble observations currently produce 10 terabytes of new data per year, with over 100 terabytes available for future generations of researchers.
- Scientists using Hubble data have published more than 12,800 scientific papers, including research that led to a Nobel Prize in Physics.



CELEBRATING WALLOPS

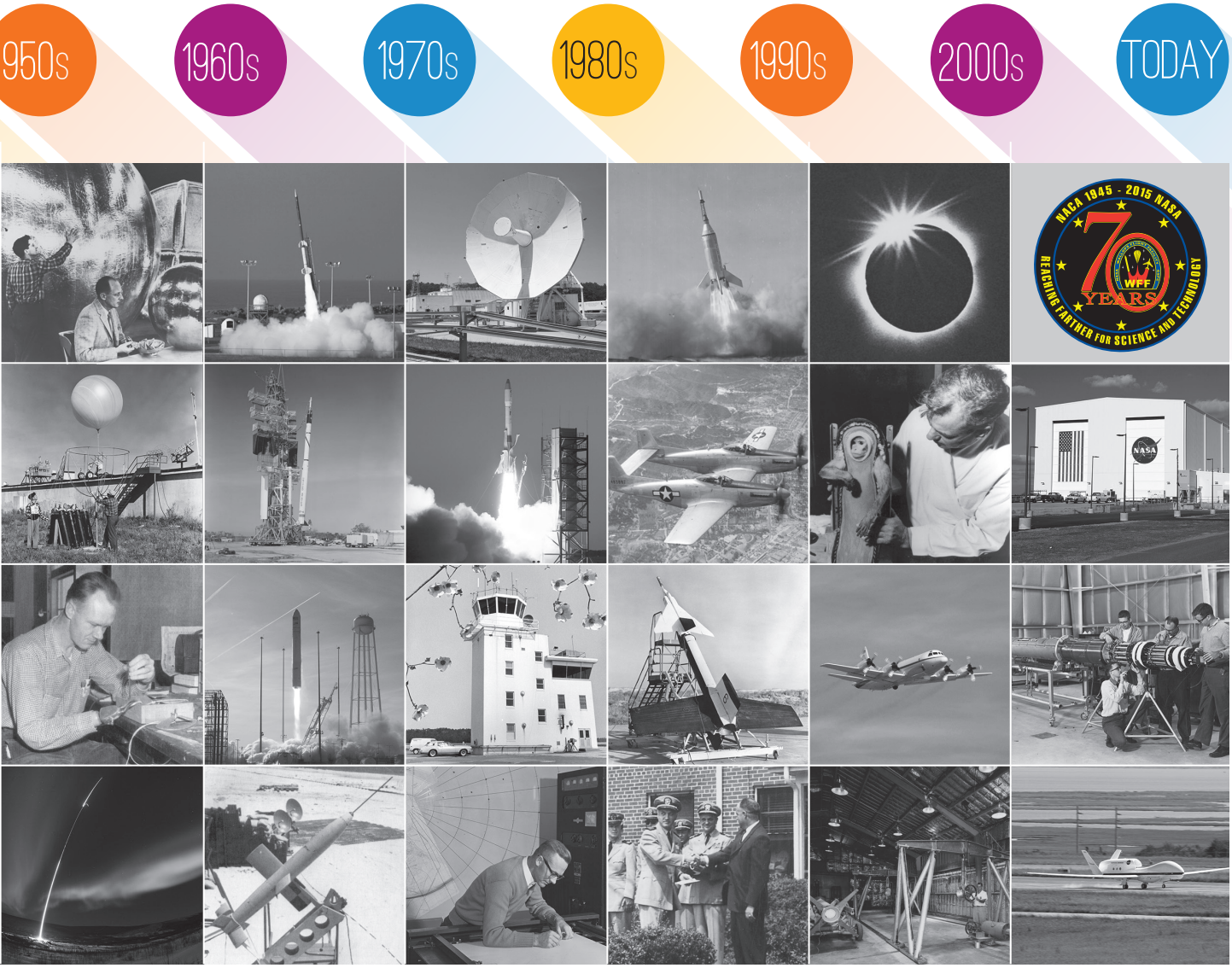
EXPANDING NASA'S REACH FOR SCIENCE AND TECHNOLOGY SINCE 1945

1940s

One of the oldest launch sites in the world, Wallops Flight Facility is a key part of Goddard Space Flight Center and NASA's principal provider of suborbital programs and related services supporting U.S. aerospace technology and science research needs. The rich history of Wallops includes and even predates the early work of NASA's predecessor, the National Advisory Council on Aeronautics (NACA).

June 27, 2015, marked 70 years since the first launch, and Wallops Flight Facility welcomed members of the public and various communities at an Open House in celebration of this milestone. Today, men and women based at Wallops lead NASA's suborbital programs, having launched thousands of rockets, released hundreds of scientific balloons, and logged thousands of flight hours in support of scientific investigations. Recent balloon missions include the launch of the Low-Density Supersonic Decelerator in Hawaii and a super pressure balloon launch from New Zealand. Recent sounding rocket missions enable scientific advances with launch platforms at Wallops, Alaska and other worldwide sites, and also support important education initiatives. Wallops' lower atmosphere airborne science missions fly 50 percent of NASA's aircraft science flight hours, with campaigns from Wallops, the Arctic, Antarctica and other global sites.

Over the years, the Wallops launch range has grown to include six launch pads, assembly facilities and state-of-the-art instrumentation. In addition, mobile launch facilities enable Goddard and NASA scientists and engineers to launch rockets from sites around the world. NASA's Wallops-based aircraft include a P-3B Orion,



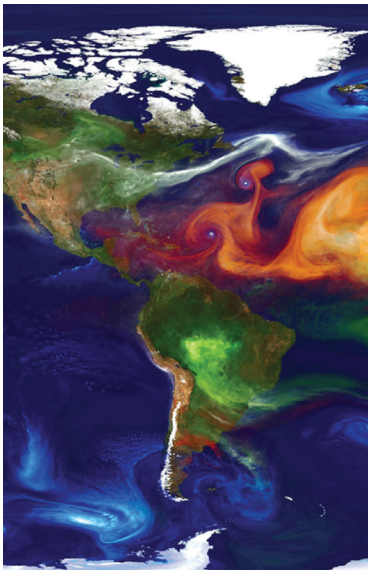
four C-23 Sherpas, a King Air, two C-130 Hercules, and a UH-1 Huey, supporting the Airborne Science Program. Wallops also supports test flights of Unmanned Aerial Systems (UAS); the Virginia Commercial Spaceflight Authority will soon complete construction of a 3,000 foot UAS runway. Wallops has NASA's only owned and operated launch range and research airport. This facility collaborates on national missions with the U.S. Coast Guard, the Department of Defense, and NOAA as well as commercial space initiatives with the Mid-Atlantic Regional Spaceport.

Recognized for pioneering innovative government, industry and academic collaboration, Wallops is poised to continue as the current and future key resource for operational test, integration and certification of NASA and commercial next-generation, low-cost orbital and suborbital launch technologies. NASA and Goddard are indebted to the commitment, service, and dedication of the countless people who have contributed to Wallops Flight Facility's important work in support of NASA's mission over many decades.

"We had an incredible 70th Anniversary celebration Saturday, June 27, with more than 7,000 guests spending the day with us, learning about our missions and the men and women who make Wallops so successful. I'm enormously grateful to all the volunteers who supported the event, as well as the exhibitors and sponsors who came out to show their support."

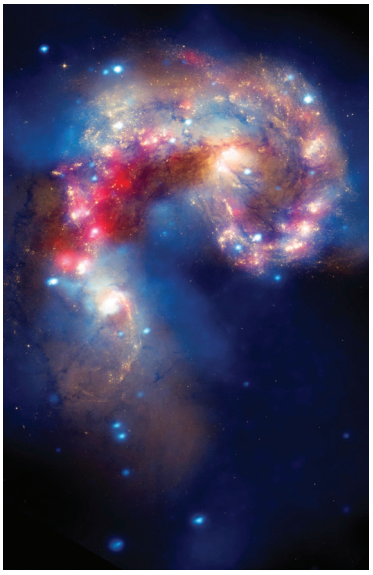
- Bill Wrobel, Director of the Wallops Flight Facility

OUR FOCUS AREAS



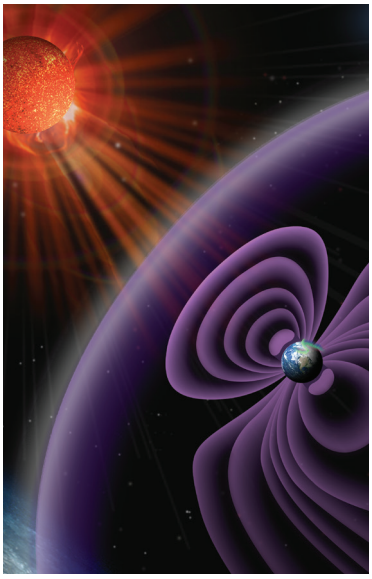
EARTH SCIENCE

Observes and studies the Earth System, to further scientific understanding of our home planet, and to improve predictions of its evolving state due to human and natural changes.



ASTROPHYSICS

Investigates the universe through astronomy, astrophysics, and fundamental physics, on issues like dark matter and energy, life-harboring planets, and black holes.



HELIOPHYSICS

Researches the Sun and its extended solar system environment (the heliosphere), and interactions of Earth, other planets, small bodies, and interstellar gas with the heliosphere.

CROSS-CUTTING TECHNOLOGIES

Sensor Systems & Instrument Platforms

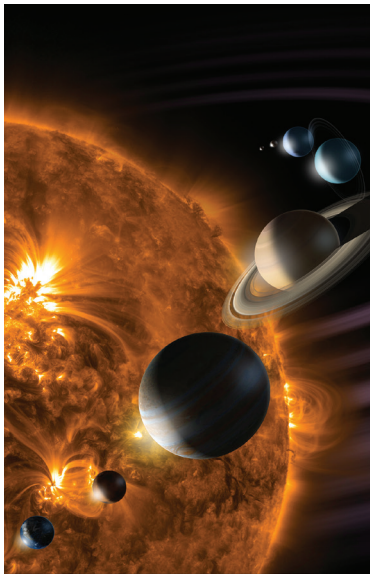
Goddard develops and builds missions and instruments, from subsystems (detectors and optical elements) to complete instruments and instrument suites.

Large-Scale Scientific Information Systems, Data Processing, & Dissemination

Goddard designs and implements custom, large-scale data systems and supercomputing applications for high-performance computing and archiving of a wide range of science data.

In-Space Satellite Servicing

To enable extended mission operations, reconfiguration, and recovery, Goddard's services include on-orbit spacecraft refueling and repair, assembling large structures in orbit, and modular designs.



PLANETARY SCIENCE

Investigates the planets, moons, and small objects in the solar system and beyond, including their evolution, inner structures, and forces that alter them.

SPACE COMMUNICATIONS & NAVIGATION

Systems, technologies and services in support of science, exploration, and space operations missions that are near-Earth and in deep space.

SUBORBITAL PLATFORMS & RANGE SERVICES

Programs and services for sounding rockets, balloons, aircraft, and commercial space including NASA's only launch facility, Wallops Launch Range.

OTHER ENABLING CAPABILITIES

Program & Project Management

Goddard conducts effective, tailored management and cost estimation, maintains schedules, develops technology, manages risk, and assures outcomes for missions and their supporting elements and services.

End-to-End Mission Systems Architecture & Engineering

Goddard addresses the full life cycle of science missions, spacecraft, *in situ* and remote-sensing instruments, and payloads from advanced concepts through implementation.

Safety & Mission Assurance

Goddard is a recognized leader in safety and mission assurance, with a lengthy history of implementing effective, innovative, and cost-effective approaches to reduce risk and enable mission success.

2015 IN FIGURES

ONE GODDARD
MORE THAN 13,000 PEOPLE

3,000+ CIVIL SERVANTS
6,000+ ONSITE CONTRACTORS
1,000s OF OTHERS*
*including off-site contractors, interns, and Emeritus

38% FEMALE (Civil Servants)

62% MALE (Civil Servants)

450 INTERNS

48 STATES
73 HIGH SCHOOLS
180 COLLEGES & UNIVERSITIES
(24% Minority Serving Institutions)

BUDGET: $5.0B
PY15 Budget Received in FY15

DIRECT GSFC BUDGET: $3.5B

REIMBURSABLE GSFC BUDGET: $1.5B
(FROM OTHER GOVERNMENT AND NON-GOVERNMENT ENTITIES)

JOINT AGENCY SATELLITES

5 AGENCIES

3 Missions in Development
Landsat 9, GOES-R, JPSS

8 Operational Missions
GOES 13-15, Landsat 7 & 8, Suomi-NPP, DSCOVR, GPM

BEST PLACES TO WORK IN THE FEDERAL GOVERNMENT RANKING

#11 OF 320 AGENCY COMPONENTS

4 YEARS OF NASA VISUALIZATION EXPLORER APP

1.5 MILLION DOWNLOADS

400 ARTICLES

- NSF/Popular Science 2015 People's Choice Vizzie Award

PUBLICATIONS

588 EARTH SCIENCE
300 ASTROPHYSICS
180 PLANETARY SCIENCE
200 HELIOPHYSICS

252 LIVES SAVED
IN THE UNITED STATES THROUGH GODDARD-ENABLED SEARCH & RESCUE

APPYLING TECHNOLOGIES

Technology Transfer
- 213 New Technology Reports
- 104 Software Usage Agreements

Invention Portfolio
- 40 Patent Applications

Partnership Development
- 11 Strategic Partnerships

JAMES WEBB SPACE TELESCOPE

5 MAJOR PROGRAM ACHIEVEMENTS HIGHLIGHTED IN FY 2015 + many more.

Please visit *http://jwst.nasa.gov/recentaccomplish.html*

Number of primary mirror segments: 18

WFF

70 YEARS OF WALLOPS INNOVATION

13,750 AIRBORNE SCIENCE HOURS ON SOUNDING ROCKET AND BALLOON MISSIONS

16 SOUNDING ROCKET LAUNCHES

3,620 COLLEGE STUDENTS PARTICIPATED IN HANDS-ON FLIGHT PROJECT EXPERIENCES (In past 18 months)

7 ORBITAL LAUNCHES (In past 3 years)

2,125 AIRCRAFT HOURS IN SUPPORT OF EARTH SCIENCE

116 SOUNDING ROCKET AND BALLOON MISSIONS (In past 18 months)

3,167 ACTIVE PROCUREMENT INSTRUMENTS

1.5 TERABYTES

OF DATA PER DAY SENT FROM THE SOLAR DYNAMICS OBSERVATORY

25-YEAR HISTORY OF U.S. FOREST DISTURBANCE MAPPED

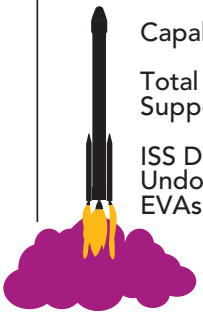
Landsat data were used to produce 25 time-integrated maps depicting forest disturbance across the U.S. These North American Forest Dynamics (NAFD) maps provide the North American Carbon Program with analyses of U.S. forest health at the scale of local forest management.

IV&V FACILITY

13 NASA MISSIONS SUPPORTED

51 SEVERITY ONE ISSUES IDENTIFIED

MISSION NETWORK



Capability: 3.8 Gbps

Total Launches Supported: 12

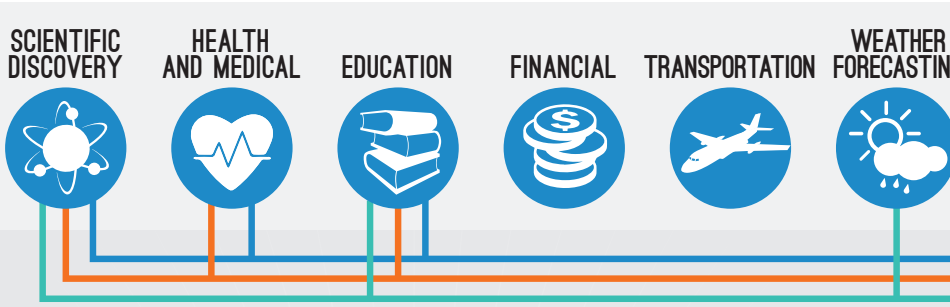
ISS Docking, Undocking, and EVAs Supported: 27

Figures are for FY 2015 unless noted otherwise.

DELIVERING YOUR DATA FROM SPACE

Since 1959, Goddard's communications networks have served NASA, the Nation, and the world as the backbone for products and services derived from satellite data.

MANY ASPECTS OF SOCIETY ARE IMPROVED BY SATELLITE DATA



HOW WE DO IT

Space Network (SN)
A constellation of nine Earth-orbiting **Tracking Data Relay Satellites (TDRS)** and four ground terminal locations that provide a continuous global link between satellites and the ground.

Near Earth Network (NEN)
A series of fifteen globally-located NASA-owned and contracted commercial ground terminals that provide comprehensive communications services to satellites in near-Earth orbit.

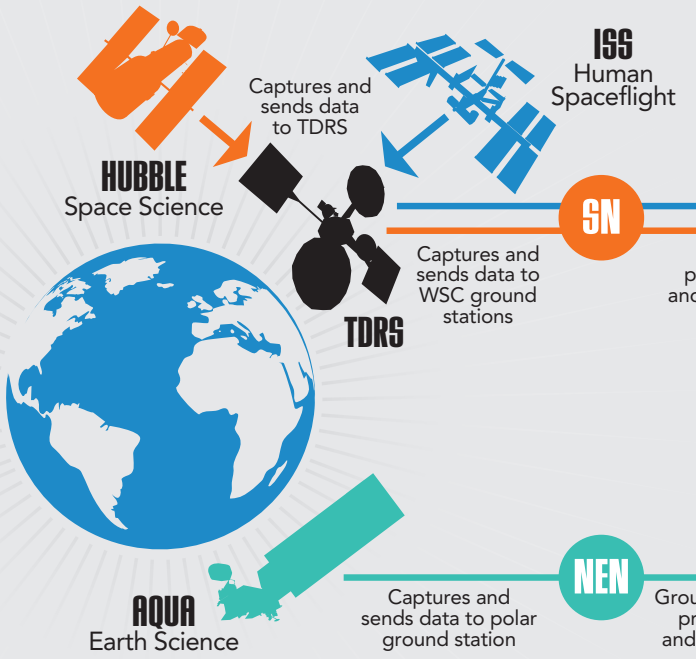
NASA Communications Network (NASCOM)
The central nervous system connected to all of NASA's communications circuits, NASCOM transports and delivers the data to control centers or data centers which process and disseminate for the science community, other agencies, and the public.

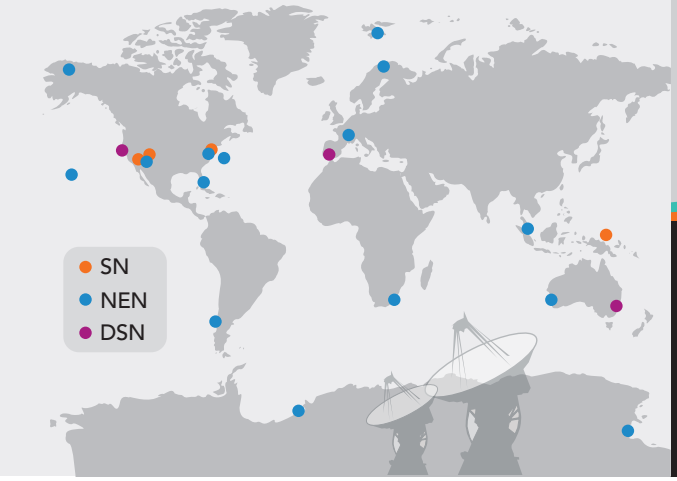
Deep Space Network (DSN)
NASCOM also provides connectivity to the ground stations of NASA's third communications network, DSN, which is managed by the Jet Propulsion Laboratory.

DID YOU KNOW?
- 98% of all NASA data comes through Goddard via SN and NEN.
- SN and NEN collectively transmit 29.5 TB of data per day.
- NEN supports about 40 NASA and other agency satellites.

JUST THREE EXAMPLES OF THE MANY WAYS WE ARE BRINGING SCIENCE HOME!

Hubble Space Telescope observes the most distant stars and galaxies in the universe as well as the planets in our solar system. The **International Space Station (ISS)** collects data on global climate, environmental change, and natural hazards using crew-operated and automated Earth observation payloads. **Aqua** is a multi-national Earth-observing research satellite studying the precipitation, evaporation, and cycling of water.





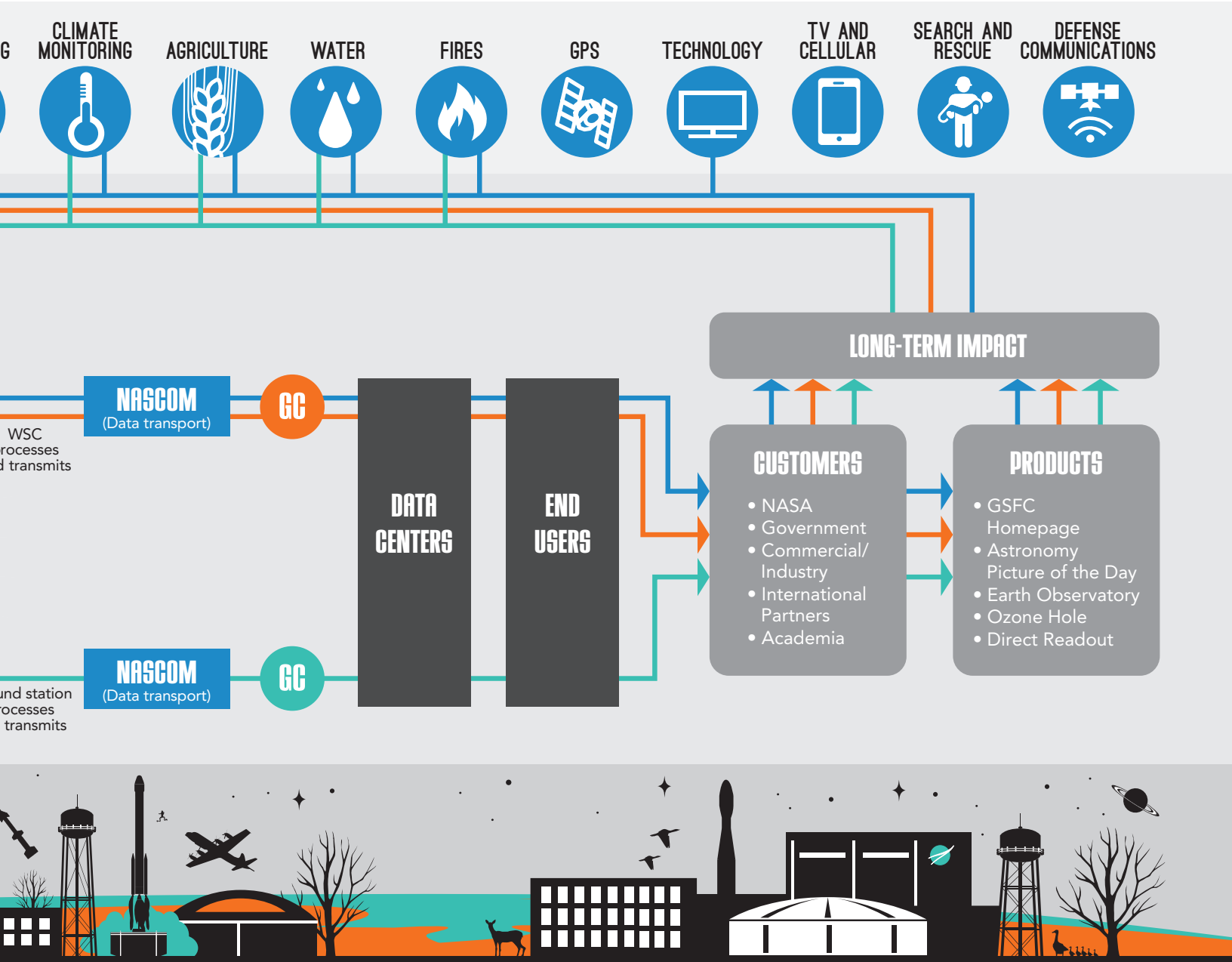
KEY FACILITIES

WHITE SANDS COMPLEX (WSC)

The SN ground segment at the White Sands Complex features ground terminals that provide the hardware and software necessary to guarantee a constant communication link among the customer spacecraft, TDRS, and the NASCOM interface to the customer control center.

WALLOPS FLIGH

One of the NASA- vide high-quality, l Global Monitor a passes allowing f other sites, includ at Kennedy Space ties to the Space



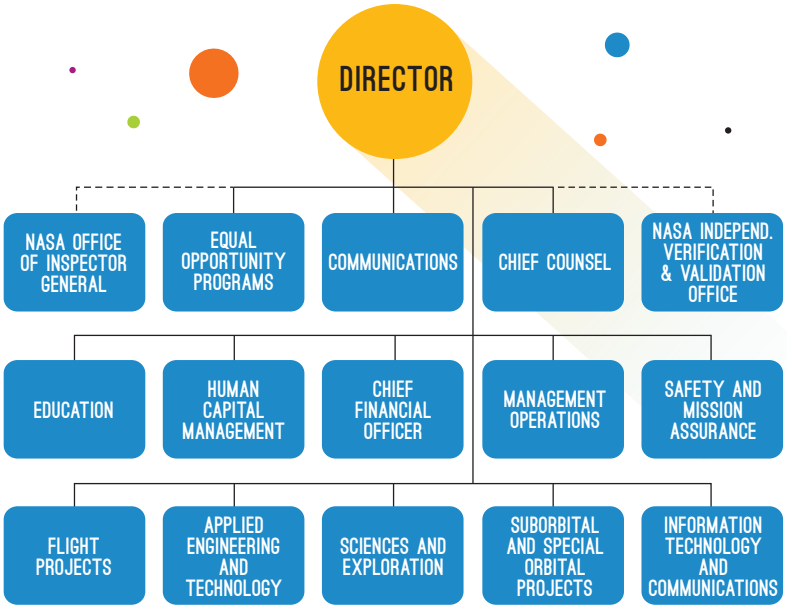
IT FACILITY (WFF)

-owned tracking stations, WFF hosts five NEN antennas that pro-
ow-cost communications services to supported flight missions. Its
nd Control Center (GMaCC) provides continual monitoring of
or remotely-controlled, locally unattended station operations at
ing the nearly completed Launch Communications Stations (LCS)
Center. LCS will provide critical launch communications capabili-
Launch System rocket and Orion spacecraft.

GODDARD GREENBELT CAMPUS (GC)

In addition to overall management of SN and NEN, Greenbelt manages the NASCOM which handles all data from SN, NEN, and DSN. Its global system of communications transmission, switching, and terminal facilities provides Internet Protocol (IP) routed data, high-rate data and video services. Other capabilities include mission voice communications services, and high volume data transfer among NASA supercomputers including the NASA Center for Climate Simulation at Goddard.

OUR ORGANIZATION

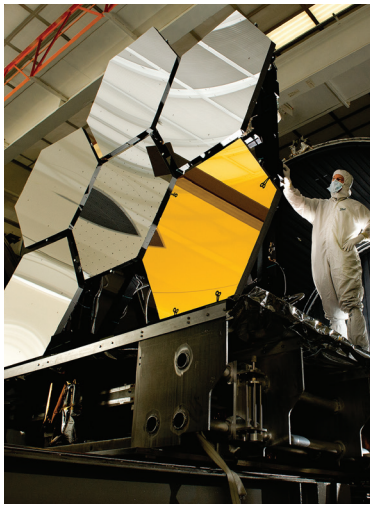


14 HIGHLIGHTS OF 2015

1 WEBB

Next Strategic Astrophysics Mission Continues Progress

James Webb Space Telescope (JWST) again made significant progress toward its launch planned for no earlier than 2018. A successful 116 days testing of its heart was conducted inside Goddard's thermal vacuum chamber. Two primary test mirror segments were placed onto the support structure. The pathfinder telescope, a practice section of JWST, is now fully assembled. The special arms required to set up its secondary mirror in space were tested. The Integrated Science Instrument Module (ISIM) successfully underwent a "gravity sag test" and "severe sound" tests.



UNIVERSE

2 HUBBLE

Celebrating 25 Years of Hubble

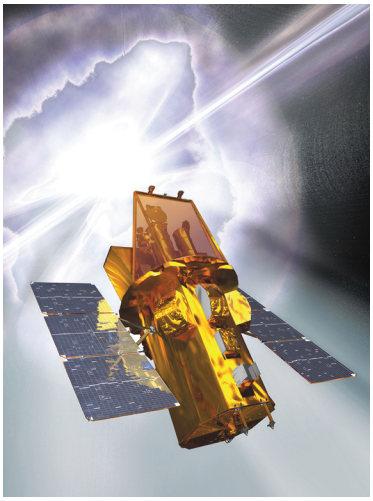
On July 23, 2015, Goddard hosted a day of open houses, events and panel discussions in honor of the project team, and they released videos showcasing key moments in Hubble's history. In addition to these recognitions, Hubble continued to deliver compelling images revealing our mysterious universe. Releases included spectacular new views of the "Pillars of Creation"; super-rich galactic neighborhoods; young, massive, compact galaxies; debris-strewn exoplanetary construction yards; extreme exoplanets; stars ejected from ancient galaxies; Pluto's moons; and aurorae on the Moon.

UNIVERSE

3 SWIFT/XMM-NEWTON

Revealing the Destructive Nature of Black Holes

The Swift Gamma-ray Burst Explorer, Chandra X-ray Observatory, and XMM-Newton joint mission with ESA are helping scientists solve an astronomical puzzle concerning forces that rip apart stars near black holes called tidal disruption. One such event, called ASASSN-14li, was found in the center of a galaxy 290 million light-years away. This observation has given researchers an extraordinary opportunity to understand these extreme environments. Results from the Nov. 2014 All-Sky Automated Survey for Supernovae (ASAS-SN) were published in the Oct. 22, 2015 issue of *Nature*.



UNIVERSE

4 GPM

First Global Rainfall, Snowfall Map from Mission

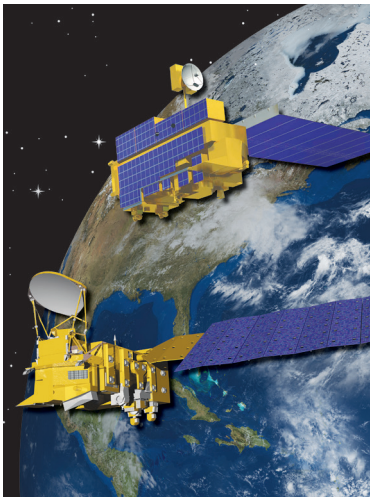
The Global Precipitation Measurement (GPM) mission has produced its first global map of rainfall and snowfall. Launched on February 27, 2014, the NASA/JAXA mission unifies precipitation measurements from a network of 12 satellites. The result is NASA's Integrated Multi-satellite Retrievals for GPM data product, called IMERG. GPM Core Observatory has provided a worldwide tour of global precipitation by taking snapshots every 30 minutes that are available in hours. In addition, GPM is engaging citizen scientists to validate ground and satellite data.

EARTH

5 TERRA/AQUA

Battling Wildfires from Space

NASA satellites have been adding to the firefighters' toolkit by providing a clearer view of these threats with new satellite-based tools to better detect fires and predict their behavior. Aqua spotted multiple fires in California, including the Rough fire—the largest in the state. Terra captured Alaskan wildfires in the 2015 fire season which surpassed the 5-million-mark for the number of acres burned. Aqua also captured an image of dozens of wildfires across the Alaska wilderness. In addition, NASA satellites captured the smoke from wildfires in the skies over Alaska, Canada, and the U.S. Great Lakes.



EARTH

6

ICESat-2

Measuring the Height of Earth from Space

The Ice, Cloud, and land Elevation Satellite-2 (ICESat-2), slated for launch in 2017, will continue the important observations of icesheet elevation change, sea-ice freeboard, and vegetation canopy height begun by ICESat in 2003. Together, these datasets will allow for continent-wide estimates in the change in volume of the Greenland and Antarctic ice sheets over a 15-year period, and long-term trend analysis of sea-ice thickness. Testing continued on ICESat-2's laser-based light detection and ranging (LIDAR) sensor called the Advanced Topographic Laser Altimeter System, or ATLAS.

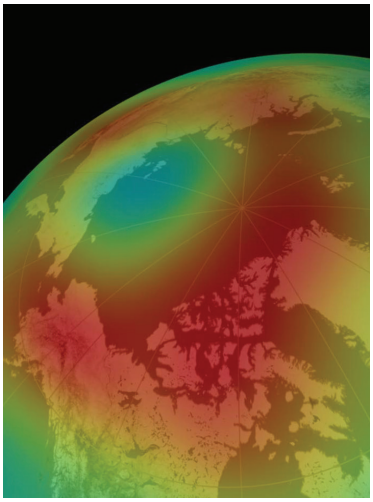
EARTH

7

PACE-OCI

New NASA Mission to Study Ocean Color

NASA is beginning work on a mission to extend critical climate measurements of Earth's oceans and atmosphere, and advance studies of the impact of environmental changes on ocean health, fisheries and the carbon cycle. Tentatively scheduled to launch in 2022, the Plankton-Aerosol Clouds and ocean Ecosystem (PACE) mission will study Earth's aquatic ecology and biogeochemistry. PACE will be managed by Goddard, which will also build the Ocean Color Instrument (OCI) to measure ocean color and observe clouds and tiny airborne particles like dust, smoke and aerosols.



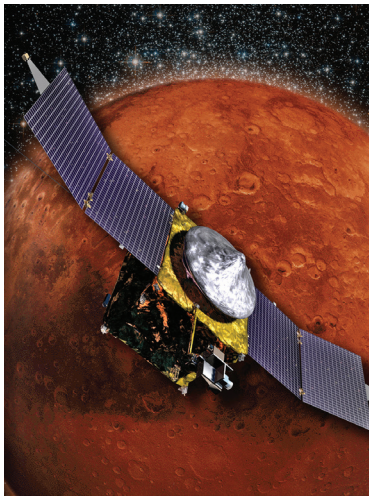
EARTH

8

MAVEN

MAVEN Extends Mars Exploration Heritage

The Mars Atmosphere and Volatile EvolutioN (MAVEN) mission continues our exploration of Mars, which began 50 years ago with Mariner 4. Since its arrival at Mars in September 2014, the results have been stunning. MAVEN has discovered diffuse auroras that occur intermittently and observed a temporary layer of metal ions, formed from dust left by comet Siding Spring. Four "deep-dip" campaigns have investigated the lower end of the upper atmosphere. MAVEN's observations are being used to determine how quickly Mars is losing its atmosphere today—to better understand its changing climate.



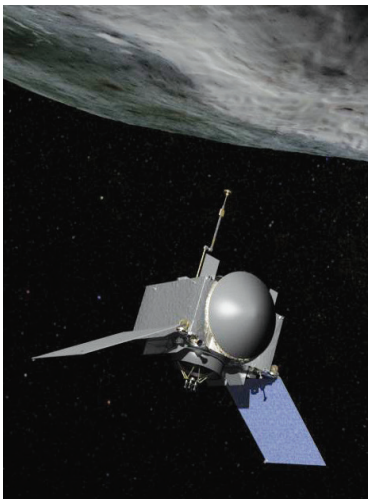
SOLAR SYSTEM

9

OSIRIS-REx

OSIRIS-REx Meets Key Milestones

Origins, Spectral Interpretation, Resource Identification and Security-Regolith Explorer (OSIRIS-REx) is the first U.S. asteroid sample return mission, planned for launch in Sept. 2016. It passed the Mission Operations Review in July 2015. That June marked the delivery of an instrument to measure the asteroid's mineral and chemical abundances, and temperature. Shortly after, two more instruments were delivered: the instrument to explore the surface of the asteroid for water and organic materials, and the suite of cameras. These three of the five mission instruments were integrated by September.



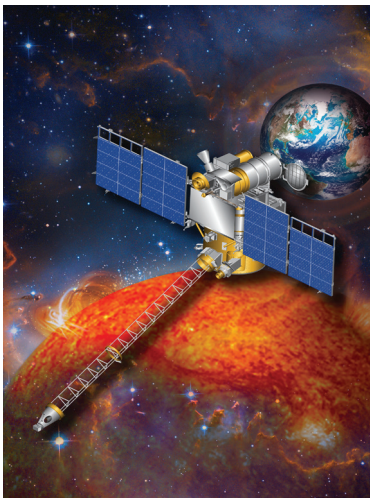
SOLAR SYSTEM

10

DSCOVR

Satellite Camera Provides "EPIC" View of Earth

In July 2015, a NASA camera on the Deep Space Climate Observatory (DSCOVR) satellite returned its first view of the entire sunlit side of Earth from one million miles away. The color images from NASA's Earth Polychromatic Imaging Camera (EPIC) are generated by combining three separate images to create a photographic-quality image. The satellite, a multi-agency collaboration (NOAA, USAF, and NASA), was launched in February. Data from EPIC will be used to measure ozone and aerosol levels in Earth's atmosphere, cloud height, vegetation properties and the ultraviolet reflectivity of Earth.



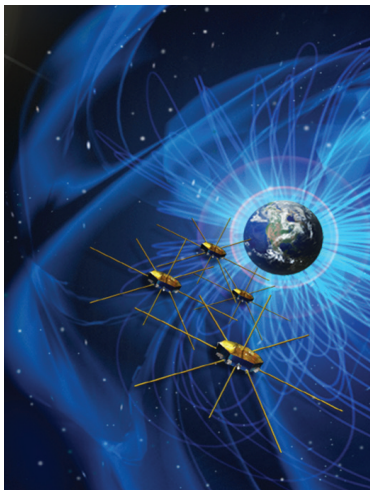
SUN

11

MMS

Historic Mission Launches, Flies in Formation

In November 2014, all four of the Magnetospheric Multiscale (MMS) spacecraft had arrived at NASA's pre-launch processing facility in Florida to begin preparations for launch. On March 12, this unprecedented mission launched to study magnetic reconnection, a phenomenon that drives effects all over the universe. On July 9, MMS completed a major milestone with the planned execution of maneuvers to begin formation flying in a 160 km spaced tetrahedron. On September 1, MMS entered the Mission Operations and Science Data Analysis phase (E), with numerous publications to follow.



SUN

12

SPACE NETWORK

Initial Implementation of New Ground Terminal

The Blossom Point Remote Station now provides customer support and is fully operational with the first of two TDRS antennas, giving the Space Network (SN) additional capability in the Atlantic Ocean Region. Blossom Point began as a green field environment, with no SN antennas or supporting ground system. In a few years, the SN installed three antennas, three radomes and a suite of hardware and software systems to manage TDRS and provide customer services. The ground system implementation effort in particular took a short 14 months from start to finish.

COMMUNICATIONS

13

WALLOPS 70th

Wallops Celebrates 70 Years of Aerospace Innovation

In 2015, Wallops hosted several events commemorating the historic date of its first test launch on June 27, 1945. The Wallops 70th Anniversary Lecture Series began in March, and Wallops held a contest on "Art & the Cosmic Connection." The facility hosted an opening reception for the youth art exhibit on June 26th. Winners selected from over 300 submissions were displayed through September. On June 27, Wallops opened its doors to engage the public with celebrating and recognizing its significant contributions to NASA and the Nation, ending with a 5K run on the facility runways.

SUBORBITAL

14

Explore@NASAGoddard

Record Crowds Visit Open House

On September 26, Goddard's main campus in Greenbelt, MD opened for the first time in four years in celebration of Hubble's 25th anniversary. Over 20,000 people attended the event. Visitors participated in over 130 science, engineering and technology activities; and interacted with experts like Nobel laureate John Mather and astronaut John Grunsfeld, a veteran of the Hubble servicing mission. Over 10 buildings were opened, including the spacecraft integration and test facility, and the High Bay Clean Room. Hundreds of the center's staff explained Goddard's work to attendees.

OUTREACH

ENGAGING THE COMMUNITY

- 20,000 Attendees
- 1,600 Staff (Volunteers, Presenters, Exhibitors, Partners, Performers, Facilities Personnel)
- 37 Presentations
- 21 Local Food Vendors
- 13 Facility Tours
- 108 Goddard Exhibits
- 22 External Exhibitors
- 14 Open Buildings
- 12 Science Demonstrations and Performances

http://www.nasa.gov/explorenasagoddard-2015

NASA's Goddard Space Flight Center in Greenbelt, Maryland, opened its doors for the first time in four years to give the public a chance to explore the center's Earth science, heliophysics, planetary science, astrophysics, and engineering and technology. In celebration of the Hubble Space Telescope's 25th anniversary, this year's event highlighted the theme "Celebrating Hubble and the Spirit of Exploration."

Organizers at Goddard said some 20,000 attended the Explore@NASAGoddard event for an exclusive look at the center's work.

Want to g

Solar Viewing
With Telescopes

Scientific Balloons

i am goddard

OUR LEADERSHIP

A PLACE FOR SUCCESS

At Goddard, we launch science. We help answer crucial science questions through complex missions that depend on dedicated, innovative teams to develop pioneering technologies. Goddard is one of the few organizations worldwide to manage a mission from concept through operations, which utilize internal, partner, and industry expertise and resources and cover suborbital to planetary missions.

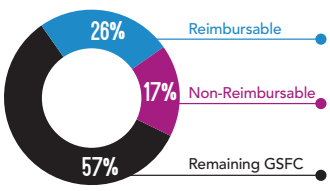
The depth and expertise of our scientists, engineers, technologists, project managers, support personnel, and facilities form the foundation of our unique strength. With our leadership in scientific research as well as instruments and spacecraft development, the center has a notable capability to conceive and manage advanced science, technology, and space systems through the entire mission life cycle.

EARTH SCIENCE

FY 2015 has yielded a number of accomplishments for Goddard Earth Science. CATS was launched to the ISS where it began observing clouds and aerosols; DSCOVR was launched into deep space (Lagrange Point 1) for a constant view of the entire sunlit hemisphere, or "blue marble"; and SMAP was launched into low Earth orbit where the GSFC-built passive microwave radiometer preserved the main objective of measuring global soil moisture. GEDI, GOES-R, JPSS, and ICESat-2 all made significant progress towards launches in 2016 and 2017. Early 2020s flagship missions Landsat 9 and PACE/OCI were formally directed to Goddard and began formulation. Unprecedented data products emerged in 2015 including: a first-ever global map of precipitation every 30 minutes from GPM Integrated Multi-Satellite Retrievals; a global map of root-zone soil moisture from a synthesis of SMAP data with the Goddard Earth Observing System Model, Version 5 (GEOS-5); and a Modern Era-Retrospective Analysis for Research and Applications (MERRA) resulting from the assimilation of satellite data into GEOS-5 to produce a refined simulation of Earth's climate system. In addition, GISS continues to monitor global temperatures and helped establish 2015 as the warmest year on record.

Combined Budget $2.1B

Combined GSFC Budget Percentage 43%



3 GSFC FACILITIES

13 LABORATORIES/OFFICES

1,267 STAFF
Civil Service, Contract, Other

MISSIONS IN DEVELOPMENT

- GEDI (Global Ecosystem Dynamics Investigation)
- GOES (Geostationary Operational Environmental Satellite – R Series)*
- ICESat-2 (Ice, Cloud, and land Elevation Satellite-2)
- JPSS (Joint Polar Satellite System)*
- PACE (Pre-Aerosol, Clouds, and Ocean Ecosystem)

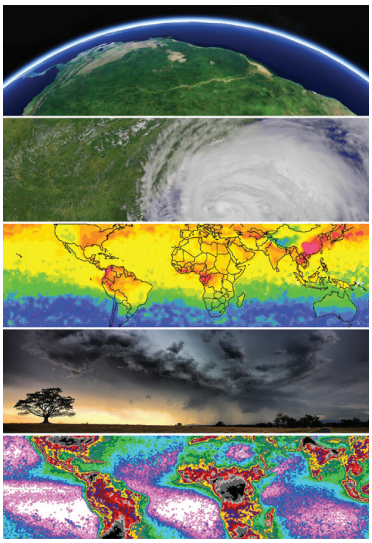
*Joint Agency Satellite

OPERATIONAL MISSIONS

- Aqua
- Aquarius
- Aura
- EO-1 (Earth Observing-1)
- CATS (Cloud-Aerosol Transport System)
- DSCOVR (Deep Space Climate Observatory)*
- GOES-13*, GOES-14*, GOES-15*
- GPM (Global Precipitation Measurement)*
- Landsat 7*, Landsat 8*, Landsat 9*
- Suomi-NPP (Suomi-National Polar-orbiting Partnership)*
- SMAP (Soil Moisture Active-Passive)
- SORCE (Solar Radiation and Climate Experiment)
- Terra
- TRMM (Tropical Rainfall Measuring Mission)

NASA Strategic Objective 2.2: Advance knowledge of Earth as a system to meet the challenges of environmental change and to improve life on our planet.

PORTFOLIO



ATMOSPHERIC COMPOSITION

HYDROSPHERIC PROCESSES

CARBON CYCLE & ECOSYSTEMS

CLIMATE & WEATHER

EARTH SURFACE & INTERIOR

PROPOSALS

(to NASA Research Announcements)

Total – **151**
PI – **73**
Co-I – **78**
Win Rate – **29%**
TBD – **42%**

PUBLICATIONS

(peer reviewed)

Refereed (total) – **588**
First Author – **35**

AWARDS

Total – **44**
Internal – **27**
External – **17**

ACCOMPLISHMENTS

NASA and the Nation are indebted to two Earth Science missions that concluded in June 2015.

- The NASA/JAXA TRMM mission delivered a 17-year dataset of tropical rainfall and lightning.
- Spacecraft SAC-D, which carried the Aquarius instrument, studied ocean surface salinity.

HIGHLIGHTS

UNDERSTANDING OUR DYNAMIC PLANET

MAKING HEADLINES

Suomi NPP Satellite Can Detect Holiday Lights From Cities
— Dec 16, 2014, TIME

It's Official: 2014 Was the Hottest Year in Recorded History
— Jan 16, 2015, Washington Post

Watch How NASA Monitors Sand Flying From the Sahara to the Amazon
— Feb 25, 2015, TIME

Risk of American 'Megadroughts' for Decades, NASA Warns
— Mar 4, 2015, CNN

NASA Releases Images of the Moon Passing in Front of the Earth From a Million Miles Away
— Aug 5, 2015, Newsweek

NASA Animation Shows World's Garbage
— Aug 24, 2015, The Weather Channel

NASA Warns Sea Levels Have Already Risen and 'It's Not Going To Stop'
— Aug 26, 2015, Forbes

NASA Satellite Spies Hurricane Joaquin Replacing an Eye
— Oct 2, 2015, Yahoo

ASTROPHYSICS

Hubble Space Telescope's return on investment has been priceless, with twenty-five years of extraordinary imagery and data helping us better understand the universe.

Swift satellite has marked 10 years of game-changing astrophysics, and remains the only satellite capable of precisely locating the universe's most powerful explosions and monitoring them before they fade from view.

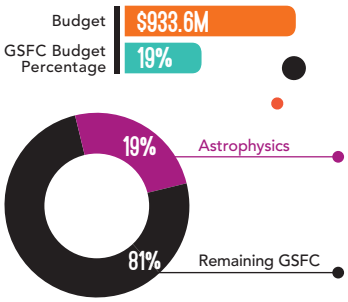
Looking ahead, the next Decadal Survey strategic astrophysics mission—JWST—has met significant integration and test milestones over the past year. JWST Program remains on schedule and within budget.

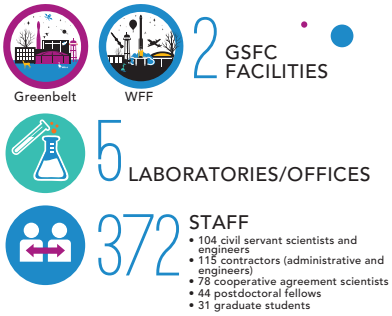
Designed as the first all-sky survey, the TESS mission was also cleared for the next development phase of its mission to search the sky for planets outside our solar system.

The X-ray timing instrument NICER has made progress toward an October 2016 launch to ISS.

Astro-H flight hardware is assembled and has completed testing with a launch date scheduled for late 2015.

WFIRST Study and Science Definition Teams completed a mission concept report and engaged the community with a request for information.





MISSIONS IN DEVELOPMENT

- Astro-H (with JAXA)
- BETTII (Balloon Experimental Twin Telescope for Infrared Interferometry)
- CALET (CALorimetric Electron Telescope)
- JWST (James Webb Space Telescope)
- Micro-X (sounding rocket)
- NICER (Neutron star Interior Composition ExploreR)
- PIPER (Primordial Inflation Polarization Explorer) (balloon)
- TESS (Transiting Exoplanet Survey Satellite)
- WFIRST (Wide-Field Infrared Survey Telescope) – pre-formulation

OPERATIONAL MISSIONS

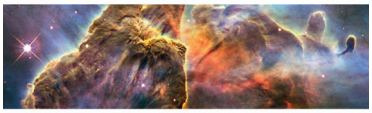
- ACE (Advanced Composition Explorer)
- CREAM (Cosmic Ray Energetics and Mass)(ISS)
- DXL (Diffuse X-rays from the Local galaxy) (rocket)
- Fermi Gamma-ray Space Telescope
- HAWC+ (High-resolution Airborne Wideband Camera) on SOFIA (Stratospheric Observatory for Infrared Astronomy)
- HEASARC (High Energy Astrophysics Science Archive Research Center)
- HST (Hubble Space Telescope) and its instruments Wide Field Camera-3 and STIS (Space Telescope Imaging Spectrograph)
- NuSTAR (Nuclear Spectroscopic Telescope Array)
- STEREO (Solar Terrestrial Relations Observatory)
- Super-TIGER (Super Trans-Iron Galactic Element Recorder) (balloon)
- Suzaku (with JAXA)
- Swift
- XQC (X-ray Quantum Calorimeter) (rocket)
- XMM-Newton (X-ray Multi-Mirror) (with ESA)

NASA Strategic Objective 1.6: Discover how the universe works, explore how it began and evolved, and search for life on planets around other stars.

PORTFOLIO

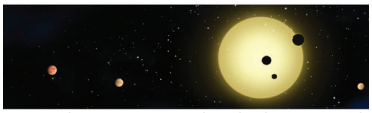
PHYSICS OF THE COSMOS

How does the universe work? Probe the origin and destiny of our universe, including the nature of black holes, dark energy, dark matter, and gravity.



COSMIC ORIGINS

How did we get here? Explore the origin and evolution of the galaxies, stars, and planets that make up our universe.



EXOPLANET EXPLORATION

Are we alone? Discover and study planets around other stars and explore whether they could harbor life.

PROPOSALS

- **51** ROSES proposals
- **17** selected, **5** pending selection decisions
- **37%** win rate

PUBLICATIONS

300 refereed scientific papers annually

20 press releases

AWARDS

- 2015 IUPAP Young Scientist Prize in Astrophysics
- John C. Lindsay Award
- Honorary Doctor of Science from University College, Dublin
- **2** Agency Outstanding Leadership Medals
- **2** Agency Exceptional Scientific Achievement Medals

HIGHLIGHTS

SEEING THE COSMOS IN A NEW LIGHT

MAKING HEADLINES

Forget Interstellar, Watch Milestones from NASA Swift's 10 Years in Space
— Nov 30, 2014, Newsweek

Gorgeous 'Pillars of Creation' Shine In New Hi-Def Hubble Photos
— Jan 6, 2015, The Huffington Post

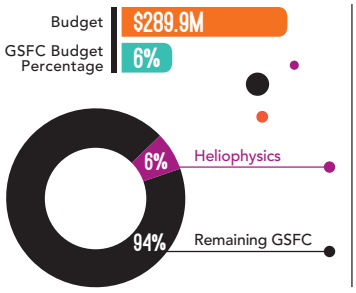
Hubble Telescope at 25—Hubble's Greatest Hits
— April 2015, National Geographic Magazine

The Best Fireworks in the Galaxy Are Coming to Earth
— Jul 4, 2015, Gizmodo

HELIOPHYSICS

In addition to the major accomplishments related to MMS and DSCOVR, 2015 marked a year of key milestones for Goddard Heliophysics. In December 2014, the Wind mission marked 20 years of characterizing the constant stream of particles from the sun. Nearing ten years of service, the Solar and Heliospheric Observatory (SOHO) discovered its 3,000th comet on Sept. 13, 2015, cementing its standing as the greatest comet finder of all time. In operation for five years, the Solar Dynamic Observatory (SDO) observed a sunspot 80,000 miles across—the largest active region seen in the current solar cycle, which began in 2008.

In addition, NASA officially confirmed the Ionospheric Connection Explorer (ICON) mission, clearing it to move forward into the development phase. ICON will explore a swath of Earth's atmosphere where weather close to the ground impacts the dynamic space environment. The EXOCUBE CubeSat successfully launched, providing flight validation of the mini-Ion and Neutral Mass Spectrometer (mini-INMS) instrument. Finally, Goddard CubeSat instruments are slated to demonstrate NASA firsts in 2016 on a small satellite called Dellingr which is taking its developers just one year to design, build, and integrate.



MISSIONS IN DEVELOPMENT

- GOLD (Global-scale Observations of the Limb and Disk)
- ICON (Ionospheric Connection Explorer)
- Solar Orbiter
- Solar Probe Plus

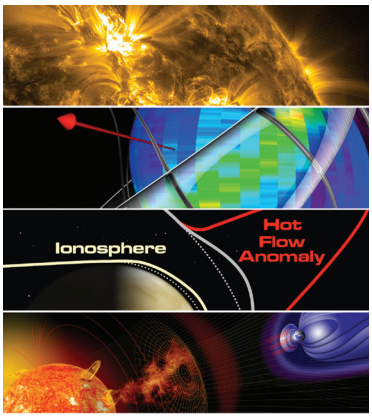
OPERATIONAL MISSIONS

- ACE (Advanced Composition Explorer)
- AIM (Aeronomy of Ice in the Mesosphere)
- CAPS (Cassini Plasma Spectrometer)
- CINDI (Coupled Ion Neutral Dynamic Investigation), VEFI (Vector Electric Field Instrument) on C/NOFS (Communications/Navigation Outage Forecasting System)
- Cluster
- DSCOVR (Deep Space Climate Observatory)*
- Geotail
- Hinode (formerlySolar-B) (with JAXA)
- IBEX (Interstellar Boundary Explorer)
- IRIS (Interface Region Imaging Spectrograph)
- MESSENGER (MErcury Surface, Space ENvironment, Geochemistry and Ranging)
- MMS (Magnetospheric Multiscale)
- RHESSI (Reuven Ramaty High Energy Solar Spectroscopic Imager)
- SDO (Solar Dynamics Observatory)
- SOHO (Solar and Heliospheric Observatory)
- STEREO (Solar Terrestrial Relations Observatory)
- THEMIS (Time History of Events and Macroscale Interactions during Substorms)
- TIMED (Thermosphere Ionosphere Mesosphere Energetics and Dynamics)
- TWINS (Two Wide-Angle Imaging Neutral-Atom Spectrometers)
- Ulysses
- Van Allen Probes (formerly RBSP - Radiation Belt Storm Probes)
- Voyager
- Wind

*Joint Agency Satellite

NASA Strategic Objective 1.4: Understand the Sun and its interactions with Earth and the solar system, including space weather.

PORTFOLIO



SOLAR PHYSICS

HELIOSPHERIC PHYSICS

GEOSPACE PHYSICS

SPACE WEATHER

HIGHLIGHTS

OBSERVING AND LIVING WITH OUR STAR

MAKING HEADLINES

Solar Flair: NASA Mission Provides Mesmerizing Images of the Sun
— Feb 16, 2015, CNN

WATCH as a Massive Eruption of Incandescent Plasma Explodes Far Into Space from the Sun
— May 5, 2015, Discover Magazine

ACE Solar Observatory to Make 3,000th Comet Discovery
— Aug 17, 2015, Discovery.com

Solar Flares From 80,000-Mile Wide Sunspot Threaten Earth
— Oct 24, 2015, Tech Times

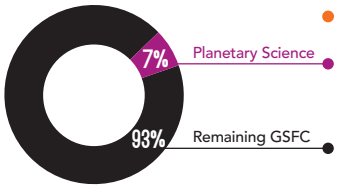
PLANETARY SCIENCE

In 2015, Planetary Science at Goddard continued its leadership related to MAVEN and OSIRIS-REx. MAVEN completed its first year in orbit, observing an unexpected high-altitude dust cloud and an aurora that reached deep into the atmosphere. OSIRIS-REx continues on schedule for a 2016 launch, with its three primary scientific instruments integrated onto the spacecraft. Additional milestones include the mapping of methane on the surface of Pluto by our infrared instrument on New Horizons. Earlier in the year, the DSCOVR mission launched with a Goddard magnetometer on board. In December 2014, our Sample Analysis at Mars (SAM) suite on the Curiosity Rover made the first detection of organic matter on the Red Planet.

As we look toward the future, work continues on the mass spectrometer for the MOMA instrument on the ExoMars mission and on magnetometers for Solar Probe Plus. In addition, our team was chosen this year to develop the thermal infrared sensor for Landsat 9 as well as a high-resolution infrared spectrometer for the Lunar Ice Cube, a mission selected under NASA's Next Space Technologies for Exploration Partnerships.

Budget $349.2M

GSFC Budget Percentage 7%



1 GSFC FACILITY

8 LABORATORIES/OFFICES

375 STAFF
Civil Service, Contract, Other

MISSIONS IN DEVELOPMENT

- OSIRIS-REx (Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer)

INSTRUMENTS IN DEVELOPMENT

- LVIS (Land, Vegetation, and Ice Sensor) conversion to NASA facility instrument
- Magnetometers for Solar Probe Plus
- Mass Spectrometer for MOMA (Mars Organic Molecule Analyzer) on ExoMars
- NASA Space Geodesy Network
- OVIRS (OSIRIS-REx Visible and Infrared Spectrometer)
- TIRS (Thermal Infrared Sensor) for Landsat 9

OPERATIONAL MISSIONS

- LRO (Lunar Reconnaissance Orbiter)
- MAVEN (Mars Atmosphere and Volatile EvolutioN)

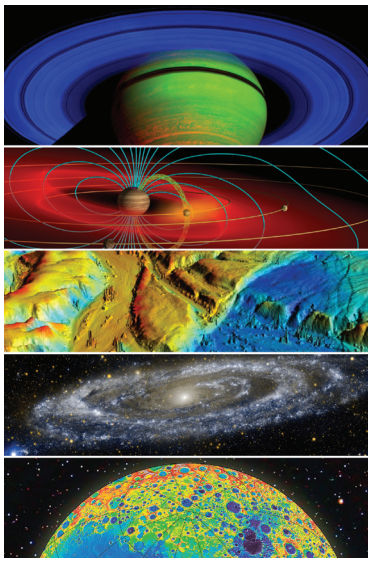
OPERATIONAL INSTRUMENTS

- Composite Infrared Spectrometer (CIRS) for Cassini
- LEISA (Linear Etalon Imaging Spectral Array) for New Horizons' Ralph camera
- LOLA (Lunar Orbiter Laser Altimeter) for LRO
- Magnetometer for DSCOVR (Deep Space Climate Observatory)*
- Magnetometers for Juno, MAVEN, Van Allen Probes, and Voyager
- MLA (Mercury Laser Altimeter) for MESSENGER
- NGIMS (Neutral Gas and Ion Mass Spectrometer) for MAVEN
- Precision Orbit Determination for GRACE (Gravity Recovery and Climate Experiment)
- SAM (Sample Analysis at Mars) Instrument Suite on Curiosity Rover
- Satellite Laser Ranging
- TIRS (Thermal Infrared Sensor) for Landsat 8
- Very Long Baseline Interferometry

*Joint Agency Satellite

NASA Strategic Objective 1.5: Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

PORTFOLIO



MASS SPECTROMETRY
Sampling on the Spot

INFRARED SPECTROMETRY
Remote Sensing

MAGNETOMETRY
The Influence of Planets

LASER AND LIDAR
Precision Measurements

ASTROBIOLOGY
Origins of Life

SPACE GEODESY
Next-Generation Mapping

HIGHLIGHTS

EXPLORING OTHER WORLDS

MAKING HEADLINES

Mars May Have Had an Ocean Comparable to Earth's Atlantic
— Mar 6, 2015, CNN

Mystery Dust Cloud and Aurora Spotted on Mars
— Mar 18, 2015, Nature

NASA's Curiosity Rover Finds Fresh Signs of Ingredients for Life on Mars
— Mar 23, 2015, Los Angeles Times

OSIRIS-REx Asteroid Sampler Enters Final Assembly
— Apr 1, 2015, Universe Today

Why This Tuesday is Going to be Exactly One Second Longer
— June 29, 2015, People

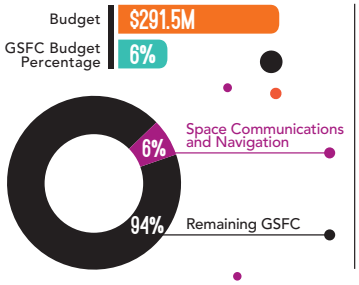
The Many Ices of Pluto's Surface, in Living Color
— July 15, 2015, Wired

This Shoebox-sized Probe Will Hunt for Ice on the Moon
— Aug 4, 2015, Popular Mechanics

How NASA's Lunar Reconnaissance Orbiter Deals With a Supermoon Eclipse
— Sept 23, 2015, BBC Newsbeat

SPACE COMMUNICATIONS & NAVIGATION

NASA's Communications Networks provide reliable and secure voice, video, and data services to support development, launch, and spacecraft operations. Critical applications include: telemetry, commands, acquisition, tracking, and raw science data. Goddard continued its reliability and strong performance, coordinating the critical communications support coverage through SN and TDRS of the test flight of the Orion spacecraft and its Delta IV rocket in December. This year, the SN debuted a new ground terminal in Blossom Point, MD, increasing its capability. The SN also performed at 99.97% proficiency, and NEN operated above 99.1% proficiency. The NEN and SN worked together to implement the McMurdo TDRSS Relay System in time for the SMAP launch, allowing for low latency data transfer. New strides in new service capabilities included an optical communications laboratory, network upgrades for the future of human spaceflight, and major studies to map the future of space relay satellites. The innovative Navigator led navigation with GEONS flight software, demonstrating GPS at a record 43,500 miles above Earth, and performing as the fastest (over 22,000 mph) operational GPS receiver in space. We also continued leadership in Search and Rescue operations, and led crash tests at NASA Langley which strengthened our position as the technical lead in the international arena.



MISSIONS IN DEVELOPMENT

- LCRD (Laser Communications Relay Demonstration)
- TDRS-M (Tracking and Data Relay Satellite)

OPERATIONAL MISSIONS

- TDRS-C-L (Tracking Data Relay Satellite)

NASA Strategic Objective 1.1: Expand human presence into the solar system and to the surface of Mars to advance exploration, science, innovation, benefits to humanity, and International collaboration.

NASA Strategic Objective 1.2: Conduct research on the International Space Station (ISS) to enable future space exploration, facilitate a commercial space economy, and advance the fundamental biological and physical sciences for the benefit of humanity.

NASA Strategic Objective 3.2: Ensure the availability and continued advancement of strategic, technical, and programmatic capabilities to sustain NASA's mission.

PORTFOLIO

SATELLITE TELECOMMUNICATIONS

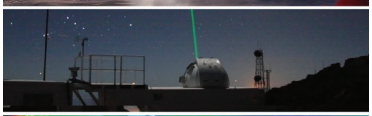
SN: Four ground terminals to support 9 TDRS spacecraft. NEN: 15 ground terminal locations with 50% of services by commercial providers.

LASER COMMUNICATIONS

Engineering lead and operations coordinator for three optical stations.

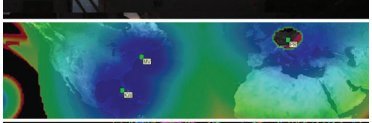
SEARCH AND RESCUE

Architecture and engineering support for 75 International GEO/LEO Local User Terminals.



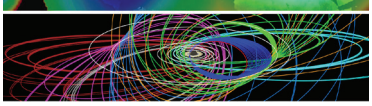
SATELLITE LASER RANGING

SLR: Operations and maintenance for 8 stations worldwide. ILRS: Global network of 40+ ground stations.



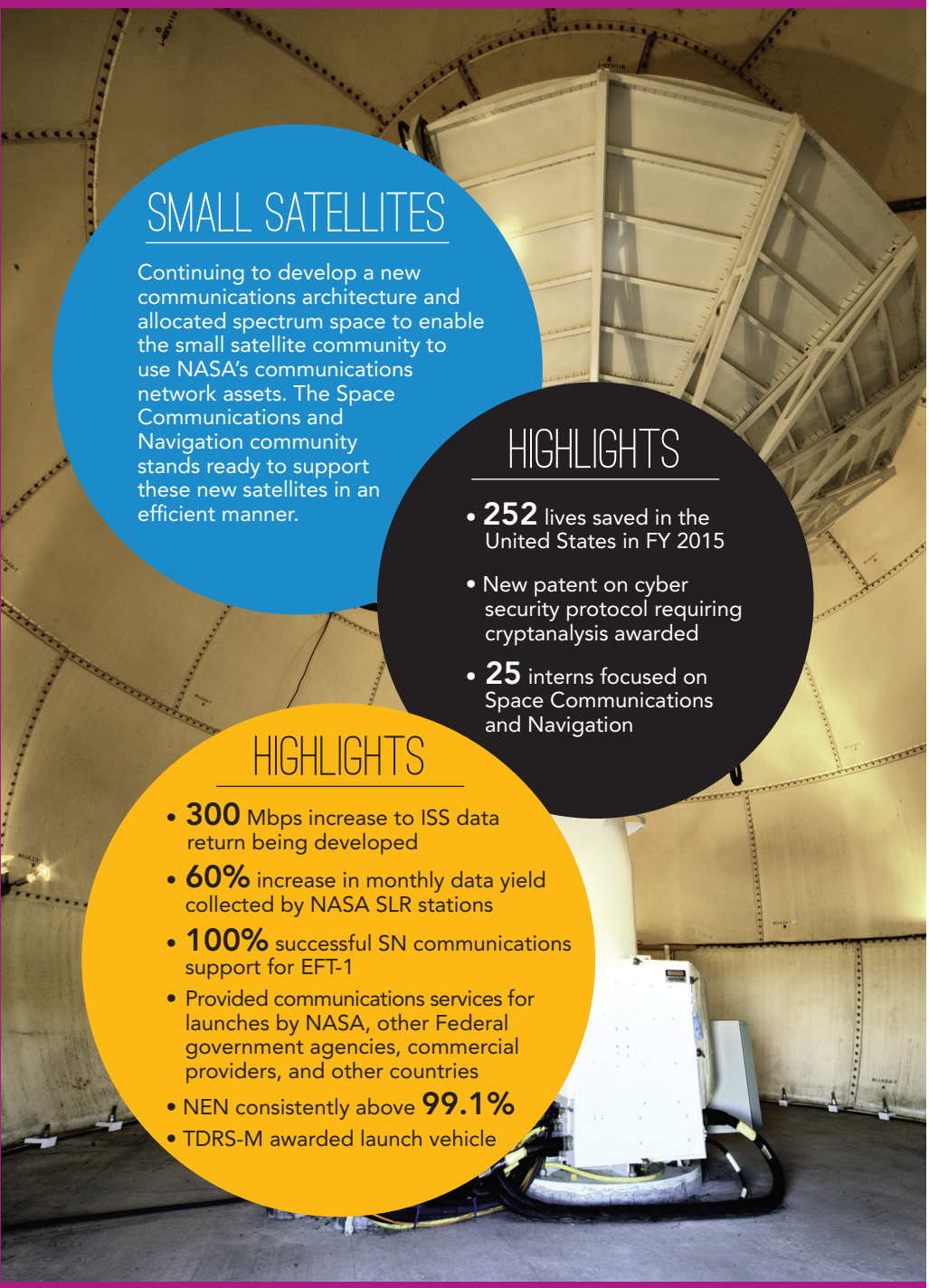
SPECTRUM MANAGEMENT

Identification of mission parameters and frequencies within radio spectrum allocations for communications or data transfer.



NAVIGATION

Life cycle trajectory designs, orbit, estimation, and associated space/ground system development.



SMALL SATELLITES

Continuing to develop a new communications architecture and allocated spectrum space to enable the small satellite community to use NASA's communications network assets. The Space Communications and Navigation community stands ready to support these new satellites in an efficient manner.

HIGHLIGHTS

- **252** lives saved in the United States in FY 2015
- New patent on cyber security protocol requiring cryptanalysis awarded
- **25** interns focused on Space Communications and Navigation

HIGHLIGHTS

- **300** Mbps increase to ISS data return being developed
- **60%** increase in monthly data yield collected by NASA SLR stations
- **100%** successful SN communications support for EFT-1
- Provided communications services for launches by NASA, other Federal government agencies, commercial providers, and other countries
- NEN consistently above **99.1%**
- TDRS-M awarded launch vehicle

HIGHLIGHTS

BRINGING KNOWLEDGE BACK TO EARTH

MAKING HEADLINES

Goddard Monitors Orion EFT-1 Test Flight
— Dec 12, 2014, NASA.gov

NASA Technology is Behind Air, Sea and Land Rescues
— July 16, 2015, NASA.gov

Why NASA Crash Testing Small Planes Could Someday Save Lives
— July 30, 2015, cbsnews.com

NASA Awards Launch Services for Next Tracking, Data Relay Satellite
— Oct 30, 2015, NASA.gov

FEATURE

Marking 50 Years of Satellite Laser Ranging

— On Nov. 13, 1964, NASA announced the first successful tracking of a satellite using brand new laser technology, a technique now standard for precisely determining satellite orbits. The "Goddard Laser" or GODLAS was fired at Explorer 22, a small satellite measuring charged particles in the ionosphere. By 1970, 5 stations in the United States and France were equipped for laser ranging. Now, more than 40 stations are located on every continent except Antarctica.

SUBORBITAL PROGRAMS & RANGE SERVICES

FY 2015 featured support across the full spectrum of NASA's missions. LDSD-2 support included a balloon launch, systems testing and range/safety for all mission events. In addition to 10 annual missions, the Balloon Program achieved a super pressure balloon launch and month-long flight from New Zealand. More than 20 sounding rocket missions flew from sites world-wide. The Hurricane and Severe Storm Sentinel completed its third year of Earth Venture flights. Sensing Hazards with Operational Unmanned Technology (SHOUT) is a NASA/NOAA effort with NASA Ames using a GSFC instrument and WFF runway/range services to study Atlantic basin weather. As part of the Mid-Atlantic Aviation Partnership, WFF is enabling UAS capabilities by hosting a Virginia-owned UAS runway on Wallops Island. ISS-CREAM systems integration was supported in advance of expected launch in FY 2016. The Wallops Incident Response Team and Safety Office provided assessment and support to the Mid-Atlantic Regional Spaceport as pad repairs were completed and tested for return to flight by spring 2016. Aircraft activities included Operation IceBridge as well as continuation of CARVE. The National Geospatial Intelligence Agency tested laser systems and equipment on WFF research range.

NASA Strategic Objective 1.7: Transform NASA missions and advance the Nation's capabilities by maturing cross-cutting and innovative space technologies.

NASA Strategic Objective 1.1: Expand human presence into the solar system and to the surface of Mars to advance exploration, science, innovation, benefits to humanity, and International collaboration.

NASA Strategic Objective 2.1: Enable a revolutionary transformation for safe and sustainable U.S. and global aviation by advancing aeronautics research.

NASA Strategic Objective 3.4: Ensure effective management of NASA programs and operations to complete the mission safely and successfully.

PORTFOLIO

SOUNDING ROCKETS

BALLOONS

AIRCRAFT

RANGE/MISSION MANAGEMENT

HIGHLIGHTS

ENABLING SCIENCE AND EXPLORATION

MAKING HEADLINES

Alaska Shows No Signs of Rising Arctic Methane

The new result shows that the changes in this part of the Arctic have not yet had enough impact to affect the global methane budget.

— Nov 17, 2014, Phys.org

Sounding Rocket Hopes to Learn What Makes Up a Supernova Remnant

"OGRESS" will study the X-rays streaming from a supernova remnant called Cygnus Loop and assess what the debris from the 20,000-year-old explosion is made of.

— May 2, 2015, NASA.gov

NASA's LDSD Project Completes Second Experimental Test Flight

A high-altitude balloon carrying the LDSD test vehicle launched from the U.S. Navy's Pacific Missile Range Facility (PMRF) on Kauai. As planned, the vehicle separated from the balloon at about 120,000 feet above the ocean. An onboard rocket motor then took the vehicle to 180,000 feet, where the first braking technology, the Supersonic Inflatable Aerodynamic Decelerator (SIAD), deployed at about Mach 3.

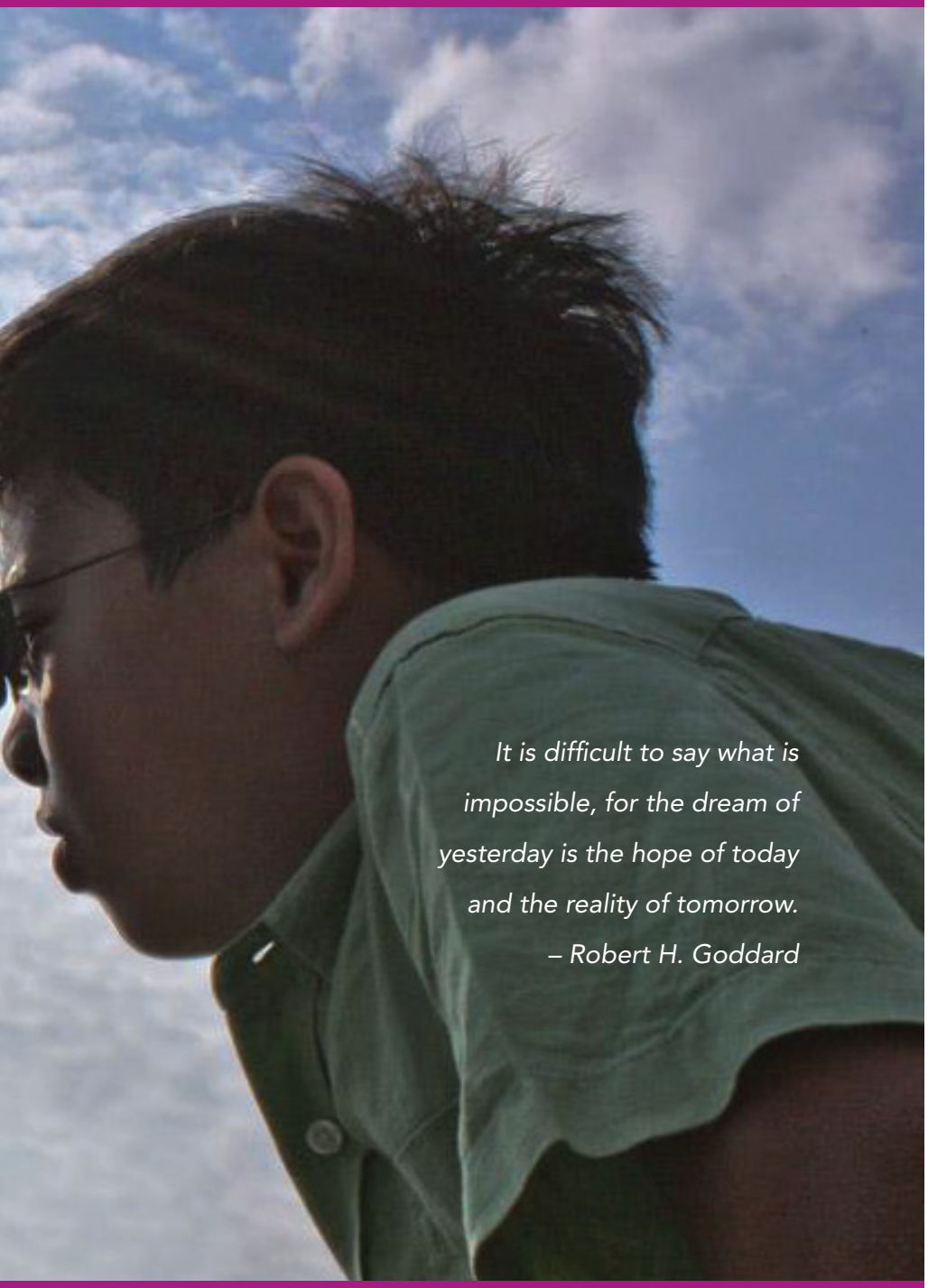
— June 9, 2015, NASA.gov

NASA's Wallops Flight Facility to Hold Open House For Public

NASA's Wallops Flight Facility is holding an open house for the public to celebrate its 70th anniversary. The event will be held on Saturday. Wallops launched its first rocket on June 27, 1945.

— June 22, 2015, The Washington Times

OUR LIFE @ GODDARD



A PLACE FOR SERVICE

Our talented people, driven by passion toward a common and worthy purpose, have made possible countless improvements to our knowledge and way of life. We safeguard the long-term public trust by cultivating our workforce, ensuring a safe and sustainable workplace, effectively meeting our mission commitments, and applying our scientific breakthroughs to stimulate economic growth, foster education, inspire the Nation, and impact the world. All of this is accomplished through a broad spectrum of institutional support efforts, including:

- Legal
- Procurement
- Information technology
- Financial management
- Human capital management
- Equal opportunity programs
- Diversity and inclusion
- Conflict management (alternative dispute resolution, anti-harassment)
- Protective services
- Environmental and medical management
- Facilities management and transportation
- Logistics
- Knowledge and information management
- Government and community relations
- Proposal development
- Education and public outreach
- Public communication

INSTITUTIONAL SUPPORT

PAVING THE ROAD TO MISSION SUCCESS

Goddard is committed to providing comprehensive center support services for its workforce and missions of today as well as transforming and preparing the center for the missions of tomorrow. Overall institutional support includes procurement operations, facilities management, protective services, medical and environmental management, and information and logistics management.

Throughout 2015, Goddard provided a safe and reliable workplace for its community, and enhanced the quality of work-life for all employees through new badging kiosks, upgrades to the Goddard Child Development Center, and upgrades to the Visitor Centers and Educator Resource Centers of Greenbelt and Wallops.

NASA Strategic Objective 3.1 Attract and advance a highly skilled, competent, and diverse workforce, cultivate an innovative work environment, and provide the facilities, tools, and services needed to conduct NASA's missions.

THE 2015 HIGHLIGHTS OF CENTER SUPPORT ENABLING GODDARD'S MISSION INCLUDE:

1. With over 3,167 active procurement instruments, Goddard has one of the agency's most diverse acquisition portfolios and leads the agency in number of procurement transactions. In FY 2015, Goddard completed 7,454 procurement actions. To ensure that the center meets its customer needs and agency commitments, Goddard also completed 15 major contract awards. In addition, Goddard exceeded its FY 2015 small business obligations at 26.5% against a goal of 22.1%.

2. Planned and executed more than $129.5M of construction, including a new Goddard integration and testing complex, a new program and project management facility, a new mission command center, and utility system upgrades for enhanced center facility readiness and reliability.

3. Provided program security support for the opening of the Tracking and Data Relay Satellite System (TDRSS) Blossom Point Facility located in Southern Maryland, and conducted necessary background investigations for 180 people needing access to the OSIRIS-REx mission technology.

4. Consistent with the center's focus on Earth science, Goddard's Site Sustainability Plan has helped reduce Goddard's energy consumption intensity by 26% from 2003 to 2015. Goddard also leads the agency on coastal resilience initiatives including the Wallops shoreline restoration program and the Mid-Atlantic Coastal Resilience Institute (MACRI).

5. Critical electrical, electronic, and electromechanical parts acquisitions ($20M) and custom shipping operations were provided for missions including Webb, GPM, ICESat-2, MMS, OSIRIS-REx, and Operation IceBridge.

6. Provided comprehensive institutional support for International Space Station resupply missions from the Wallops Flight Facility.

IT AND COMMUNICATIONS

ADVANCING NASA'S WORK THROUGH IT

Goddard works diligently to provide its workforce with the Information Technology and Communications needed to achieve the center's science and technology mission in support of NASA's goals. FY 2015 featured many related accomplishments that provided positive impact to the Goddard community, contributed to an effective workplace, and enabled mission success.The Next Generation Voice project replaced Goddard's aging telephone system with a modern, IP-based system that provides greater scalability, mobility, and cost savings. It allows employees to make and receive calls from their desk phone numbers even when working offsite. The Wireless Upgrade Project expanded wireless service to more buildings across Goddard's Greenbelt campus, providing faster network speeds and more consistent access to employees. The Mission Launch Command Center (MLCC) project limited costly damage to Wallops Flight Facility's IT infrastructure from the Antares launch failure by burying exposed cables and improving the cable plant infrastructure to support range and launch facilities on the south end of Wallops Island. Goddard's Solutions for Enterprise-Wide Procurement (SEWP) Program released SEWP 5, a government-wide acquisition vehicle for IT products and solutions with a total value of $20 billion over five years. SEWP's effective management resulted in the lowest fees of any government-wide acquisition contract. Goddard made progress on the Federal Data Center Consolidation Initiative by consolidating two data centers at Greenbelt, reducing power consumption and improving disaster recovery and security. Goddard also made progress against OMB's requirement to use PIV smartcards for authentication by enabling employees to use their smartcards to log into their Windows 7 machines, resulting in both a more secure environment and an enhanced user experience with fewer passwords to remember.

ONGOING PROJECTS:

- Mission Network: Goddard is leading the deployment of the next generation of NASA mission networks through two Agency projects: the Mission Next Generation Architecture (MNGA) and the Mission Backbone Transition (MBT). These projects will provide improved and expanded capabilities to support spaceflight and other mission customers, while improving security, accelerating service delivery and reducing recurring backbone circuit costs by an anticipated $2M annually.
- Web Services: Goddard is working with center web site owners to move to IPv6, the next version of the internet protocol. This project will make web browsing faster and more secure.
- Cybersecurity: Goddard continues to focus on security, providing continuous diagnostics and mitigation to address incidents and vulnerabilities and work proactively with customers to improve the center's security posture.

NASA Strategic Objective 3.3: Provide secure, effective, and affordable information technology and services that enable NASA's mission.

PORTFOLIO

MANAGEMENT AND OPERATIONS

INFORMATION SECURITY

COMMUNICATIONS

END USER SERVICES

APPLICATIONS

DATA CENTER

PUBLIC COMMUNICATION

SHARING NASA WITH THE WORLD

Scientific exploration leads to new knowledge, technology, and capabilities that Goddard then extends to industry and the public as ultimate customers and beneficiaries. Through efforts in communication and outreach, Goddard is committed to engaging these stakeholders in shaping and sharing the experience, benefits, and importance of exploration and discovery related to Earth and space.

The external website, *www.nasa.gov/goddard*, is Goddard's most accessible and centralized communication tool and gateway to the center's latest images, videos, news, and resources.

THE GATEWAY TO GODDARD

NASA Strategic Objective 3.1: Attract and advance a highly skilled, competent, and diverse workforce, cultivate an innovative work environment, and provide the facilities, tools, and services needed to conduct NASA's missions.

Social Media

Social media services link Goddard's websites, news, activities, and outreach efforts, and provide a direct line of communication with the center's customers and the broader online community.

The Stories We Tell

In calendar year 2015, Goddard published 1,034 articles on its website. Here are the top ten.

Multimedia and Television Production

During 2015, 109 multimedia videos were created. The top 13 videos of the year amount to 25 million plays, a quarter of the 100+ million total for Goddard's YouTube account. The four top videos of this year are also in Goddard's all-time top 10, spanning nearly 10 years on YouTube.

Visitor Center and Tours

Visiting stakeholders and community groups experienced Goddard's compelling missions, facilities, and people first-hand.

Media Resources

These resources include products, activities, and access to Goddard facilities and experts that enable external organizations to acquire and share knowledge about the NASA.

Outreach Events

Outreach events led by both the center and the agency engage the public and stakeholders with specific NASA missions and accomplishments. In addition to the open houses at Greenbelt and Wallops this year, the center participated in the following notable engagement activities.

	Date
	12/31/20
	12/30/20
	Growth

Top 10 Ar	
1	Hubble's
2	From a M
3	NASA Stu
4	Goddard'
5	Views of

Top 13 Vi	
1	SDO
2	Ther
3	Sup
4	Mas
5	A Vi
6	Jupi
7	5 Ye

- Total atten
- 16,686 pe
- For FY 201
- The Visitor nationwide Space Tele through th

12 Live Sh

- Comet Sid
- Sunspot
- 2014 Warn
- Soil Moistu
- Magnetos
- New Glob

- VIP Center
- The 16th A presented
- Maryland engaged a
- Celebratio activities o

2015 PUBLIC COMMUNICATION HIGHLIGHTS

	FANS/FOLLOWERS/SUBSCRIBERS					TOTAL VIEWS	
	Facebook	Instagram	Twitter	Twitter (photo)	YouTube	YouTube	Flickr
14	611,606	709,342	207,838	144,315	223,938	70,515,363	140,282,123
15	926,098	1,295,961	294,214	253,802	326,807	105,977,693	182,444,180
n	**51.4%**	**82.7%**	**41.6%**	**75.9%**	**45.9%**	**50.3%**	**30.1%**

ticles	Views
High-Definition Panoramic View of the Andromeda Galaxy	851,092
illion Miles Away, NASA Camera Shows Moon Crossing Face of Earth	644,043
dy: Mass Gains of Antarctic Ice Sheet Greater than Losses	452,136
s Homepage	426,412
Pluto Through the Years	398,215

Top 10 Articles		Views
6	NASA Scientist Sheds Light on Rare Sept. 27 Supermoon Eclipse	328,698
7	Hubble Goes High-Definition to Revisit Iconic "Pillars of Creation"	309,173
8	NASA Mission Reveals Speed of Solar Wind Stripping Martian Atmosphere	292,177
9	NASA Releases New High-Resolution Earthrise Image	239,865
10	Hurricane Patricia	214,716

deos of 2015	Plays
: Year 5	4,616,984
rmonuclear Art – The Sun In Ultra-HD (4K)	4,286,637
ermoon Lunar Eclipse	3,951,531
ssive Black Hole Shreds Passing Star	3,393,443
ew From The Other Side	2,297,461
iter in 4k Ultra HD	2,040,268
ar Time-lapse of the Sun	760,039

Top 13 Videos of 2015		Plays
8	Measuring Mars' Ancient Ocean	712,780
9	Solar Wind Strips Martian Atmosphere	660,496
10	Satellite Tracks Saharan Dust to Amazon in 3-D	581,341
11	2014 Continues Long-Term Global Warming	576,038
12	Arching Eruption	420,015
13	Earth and Moon Photobomb SDO	299,929

dance for FY 2015 at the Visitor Center was 56,600, which includes 20,000 attendees of Explore@NASAGoddard.
ople attended tailored meetings, events, and programs at the Visitor Center in FY 2015.
15, 368 tour groups were conducted for a total of 9,806 attendees.
r Center debuted two major exhibits in 2015: 1) The "Solarium" art installation derived from SDO imagery was also installed at other locations
e and highlighted by ArchitecturalDigest.com, National Geographic, andSpace.com; 2) A ribbon-cutting ceremony unveiled the James Webb
escope exhibit. As Webb's assembly continues and its 2018 launch date approaches, space enthusiasts can learn about the premier observatory
is dynamic, interactive exhibit.

ot Campaigns		338 Interviews
ding Spring mest Year on Record ure Active Passive (SMAP) Pre-launch Campaign pheric Multiscale (MMS) Mission Pre-launch Campaign al Precipitation Map - GPM IMERG	• Hubble Space Telescope Celebrates 25 Years • NASA's "Flying Saucer" Ready for Test Flight (LS for HQ) • Historic New Horizons Pluto Flyby • A Tale of Two Extremes: Droughts and Floods • Sea Level Rise • Rare Supermoon Eclipse	• 302 Satellite Interviews • 17 In-person Interviews • 6 Print Interviews • 13 Radio Interviews

r Facility Tours were held 105 times throughout the year serving 1,544 participants.
Annual Goddard Fall Reception and Lecture was held at the Smithsonian National Air and Space Museum (NASM) on September 30, 2015,
by the Maryland Space Business Roundtable (MSBR) and Goddard.
Day 2015 was organized by the University of Maryland, College Park, to engage the public with the school and local community. Goddard
attendees with NASA science and technology.
on of the 45th Earth Day involved employees agency-wide. Goddard contributed with hyperwall presentations, demonstrations, and hands-on
during events on the National Mall and Union Station in Washington, DC.

EDUCATION

INSPIRING THE FUTURE

We are driven by NASA's education vision: *"To advance high quality Science, Technology, Engineering, and Mathematics (STEM) education using NASA's unique capabilities."* As a result, Goddard education is grounded in the work of NASA's missions, projects, engineering, and IT services to provide exceptional opportunities for learners, educators, and institutions across an 11-state service region and nationwide through four lines of business. The following represent a few notable highlights from 2015.

NASA Internships, Fellowships, and Scholarships invest in NASA's workforce of tomorrow through competitive awards and financial assistance that enable real-world learning opportunities for students pursuing STEM careers today.

- In 2015, 450 high-school through doctoral-level interns and fellows worked alongside Goddard scientists, engineers, and technologists at Greenbelt, GISS, IV&V, WSC, and Wallops. Approximately 36% of interns were from underrepresented populations.
- A year-long Climate Change Research Initiative pilot program launched at GISS, involving teams of GISS scientists; high school educators; and graduate, undergraduate, and high-school students.

Educator Professional Development programs train educators to nurture NASA's STEM students through in-person institutes, partner-delivered workshops, online- and distance-learning, as well as local, state, and regional community programs.

- Goddard partnered with Maryland, Pennsylvania, West Virginia and Virginia education agencies to increase in-service, pre-service, and informal educators' ability to deliver NASA STEM content and inspire completion of STEM degrees.
- Four week-long solar system exploration education workshops brought 148 middle school educators from the U.S. and India to Goddard. A fifth workshop engaged 31 librarians from DC and Prince George's County, MD.
- GISS, the Intrepid Sea, Air & Space Museum and Queens College, City University of New York supported three days of GLOBE training, expert talks, and activities for teachers in New York City.
- Twenty high school educators from Maryland, Virginia, New York, New Jersey, Georgia, Pennsylvania and Delaware successfully completed the Wallops Rocket Academy for Teachers & Students.

Institutional Engagement builds the academic and research capacity of partner institutions to increase the participation of minorities and underrepresented communities in NASA-related STEM.

- Goddard's Maryland Historically Black Colleges and Universities (HBCU) Pre-Service Education Network is a collaboration with Bowie State University, Coppin State University, Morgan State University and the University of Maryland Eastern Shore. The network developed STEM content modules, trained 32 pre-service teachers, and delivered content to 175 middle and high school students at community-based summer camps.
- Thirty-nine high school students, counselors, and faculty from the Morehouse College and Clark

NASA Strategic Objective 2.4: Advance the Nation's STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers, and faculty in NASA's missions and unique assets.

Atlanta University learned about NASA engineering, aviation and STEM careers at Wallops.

- The week-long Summer Institute in Science, Technology, Engineering, and Research (SISTER) Program engaged 40 middle school girls with STEM activities and female professionals.
- Goddard staff and the center's National Society of Black Engineers chapter helped organize the HBCU Week Conference (1200 attendees) and the 2015 Conference of the National Society of Black Physicists (600 attendees).
- This year's RockOn-RockSat-C workshops at Wallops in collaboration with the Colorado and Virginia Space Grant Consortia included students from Tribal Colleges and Universities.

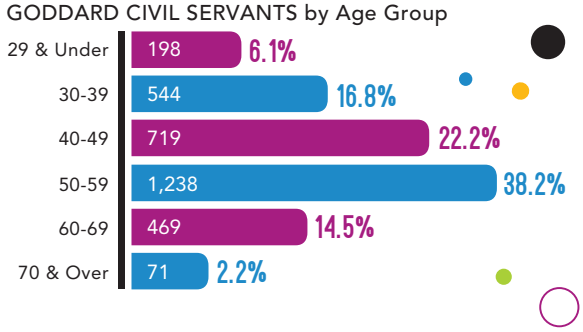
STEM Engagement opportunities increase awareness, involvement, and interest of learners of all ages by connecting them to NASA-unique resources through public events, experiential learning opportunities and NASA challenges.

- Goddard provided heliophysics education expertise in support of the White House Astronomy Night, showcasing Mars and MMS content for 400 participants.
- Female Goddard professionals from many technical areas and center organizations supported the U.S. Department of State International Visitor Leadership Program by meeting with 15 female educators, researchers, and scientific leaders from 14 different countries.
- Eighty-three high school sophomore Virginia Space Coast Scholars (VSCS) participated in a week-long residential summer STEM academy that covered mission activities at Wallops and the Mid-Atlantic Regional Spaceport.
- IV&V Program's equipment loan program, which certifies educators in the use of 29 NASA and STEM-based educational kits, served over 15,000 students in 2015.

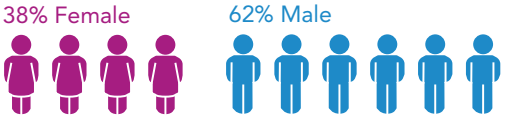
- Five undergraduate students, a graduate assistant, and a faculty member of Stony Brook University's School of Journalism accompanied a Goddard-led field team to Hawaii to document NASA research through scientific reporting. This solar system education effort provided unique experience and enhanced understanding of NASA missions.
- Goddard hosted 67 U.S. and international students from the National Student Leadership Conference for Engineering. They toured the Greenbelt campus and learned about NASA careers.
- Over 1,200 students, faculty, and visitors were engaged with Wallops content during the Virginia Science Festival and the Virginia Polytechnic Institute and State University Family Weekend.
- As part of Physics of the Cosmos and Cosmic Origins education programs, the first episode of a Space Forensics interactive educational game has been released, allowing solvers to investigate the mystery of exploding stars.
- Goddard extended facility tours and NASA content to 100 middle and high school boys participating in the College Success Foundation's HERO (Higher Education Readiness Opportunity) Summer Leadership Academy that provides scholarships and mentoring to low-income, high potential students.
- IV&V Educator Resource Center and Fairmont State University collaborated with 7 robotics programs, with 16 tournaments hosted by 12 unique partners. More than 200 K-16-level teams are participating in over 30 West Virginia counties.

CURRENT STATE OF THE WORKFORCE 2015

GODDARD CIVIL SERVANTS by Age Group

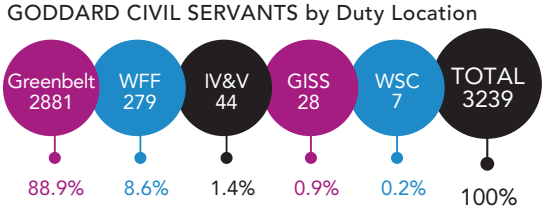


GODDARD CIVIL SERVANTS by Gender

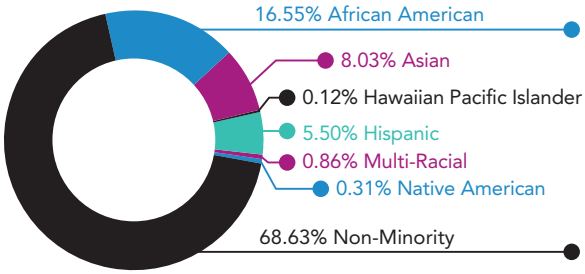


GODDARD CIVIL SERVANTS by Disability

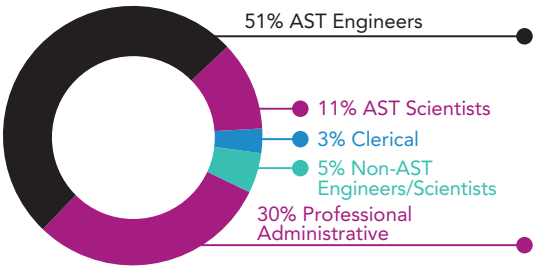
GODDARD CIVIL SERVANTS by Duty Location



GODDARD CIVIL SERVANTS by Ethnicity



GODDARD CIVIL SERVANTS by Skill Mix



BEST PLACES TO WORK IN THE FEDERAL GOVERNMENT

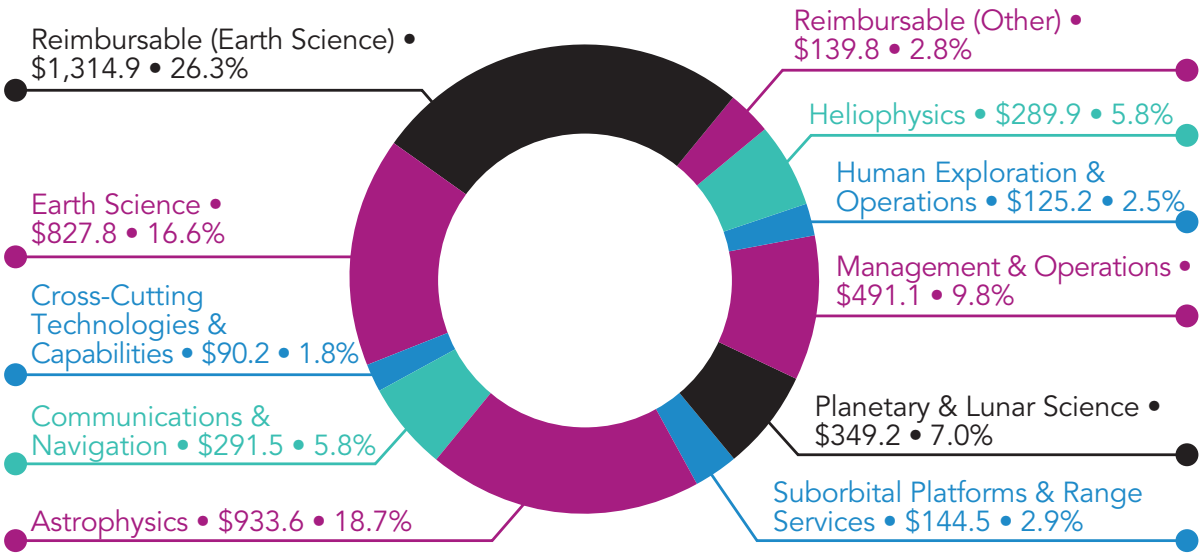
http://bestplacestowork.org

Scores By Category	2015 Rank	2015	2010	2005
Overall	11 of 320	78.6	79.5	73.9
Teamwork	11 of 319	80.6	77.4	79.6
Innovation	4 of 318	79.9	78.8	N/A
Effective Leadership	6 of 318	72.4	70	64.6
Support for Diversity	4 of 319	76.4	77.2	76.5
Training and Development	13 of 319	76.5	75.5	72.5
Employee Skills-Mission Match	8 of 319	84.8	84.7	80.5
Work-Life Balance	29 of 319	71.2	67.7	67.8
Performance-Based Rewards & Advancement	6 of 318	65.4	64.2	60.9

BUDGET

GSFC Program Year 2015 BUDGET Categorized by Lines of Business (as of 9/30/15)

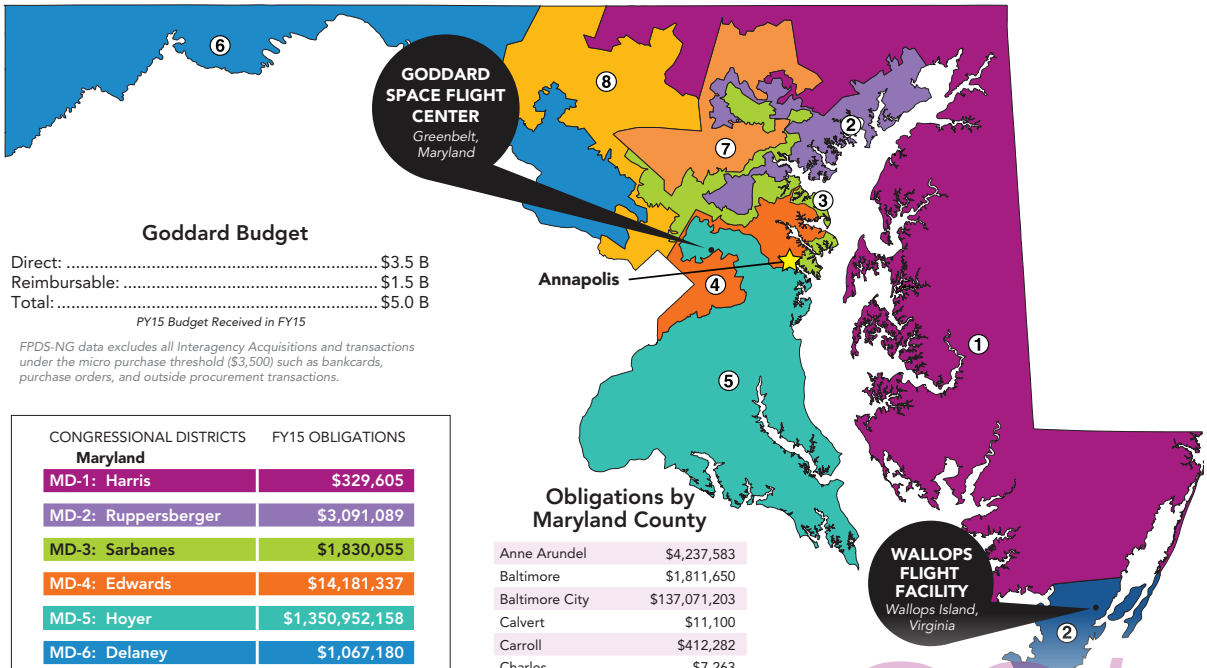
Chart is in $Ms



ECONOMIC IMPACT

Goddard's success in enabling NASA missions and applying these scientific achievements to society is evident. Each of Goddard's five locations supports the center's ability to stimulate and strengthen economic activity by:

- Expending goods and services to perform its mission.
- Generating technology transfer and spinoff activities.
- Broadening small business opportunities through its robust contracting program.



Goddard Budget

Direct:	$3.5 B
Reimbursable:	$1.5 B
Total:	$5.0 B

PY15 Budget Received in FY15

FPDS-NG data excludes all Interagency Acquisitions and transactions under the micro purchase threshold ($3,500) such as bankcards, purchase orders, and outside procurement transactions.

CONGRESSIONAL DISTRICTS	FY15 OBLIGATIONS
Maryland	
MD-1: Harris	$329,605
MD-2: Ruppersberger	$3,091,089
MD-3: Sarbanes	$1,830,055
MD-4: Edwards	$14,181,337
MD-5: Hoyer	$1,350,952,158
MD-6: Delaney	$1,067,180
MD-7: Cummings	$139,340,672
MD-8: Van Hollen	$3,144.872
Virginia	
VA-2: Rigell	$143,330,983
ALL DISTRICTS	**$1,513,936,968**

Obligations by Maryland County

Anne Arundel	$4,237,583
Baltimore	$1,811,650
Baltimore City	$137,071,203
Calvert	$11,100
Carroll	$412,282
Charles	-$7,263
Frederick	$48,105
Harford	$149,293
Howard	$1,925,524
Montgomery	$3,951,997
Prince Georges	$1,364,299,247
Washington	$14,387
Wicomico	$11,860
Total	$1,513,936,968

Goddard invests over 80 cents of every dollar it receives in American businesses, academia, and nonprofit organizations.

Goddard's Top Contractors

1. LOCKHEED MARTIN CORPORATION $463.7 M
2. NORTHROP GRUMMAN SPACE AND MISSION SYSTEMS CORPORATION $402.4 M
3. RAYTHEON COMPANY $328.8 M
4. EXELIS INC. $307.0 M
5. SGT, INC. $235.8 M
6. ORBITAL SCIENCES CORPORATION $165.2 M
7. AS AND D, INC. $149.6 M
8. ASSOC UNIV RESEARCH ASTRONOMY $137.0 M
9. BALL AEROSPACE AND TECHNOLOGIES CORPORATION $116.6 M
10. GENERAL DYNAMICS C4 SYSTEMS, INC. $116.3 M
11. HONEYWELL TECHNOLOGY SOLUTIONS INC. $87.1 M
12. INUTEQ, LLC $67.5 M
13. THE REGENTS OF THE UNIVERSITY OF CALIFORNIA $62.0 M
14. LJT & ASSOCIATES, INC. $60.3 M
15. SCIENCE SYSTEMS AND APPLICATIONS INCORPORATED $55.9 M

All numbers are based on NPDV and FPDS obligation data for FY14 as of 3/26/15. Not based total contract value.

ENVIRONMENTAL IMPACT

GREEN GODDARD: With its unique understanding as a global leader in Earth Science, Goddard is committed to identifying and implementing strategies that ensure continued human progress, productivity, and prosperity while sustaining natural species and systems.

The 2014 Sustainability Report evaluated the relationships among Goddard's activities and natural systems, resources, and local communities. The center then produced a 2015 Sustainability Plan in response to White House Executive Order 13693: *Planning for Federal Sustainability in the Next Decade*.

- Mid-Atlantic Coastal Resiliency Institute (MACRI)
  - Launched in June 2014, the MACRI is a Goddard-led, multi-state, multi-disciplinary research collaboration among 12 world-class organizations that aims to integrate science and its applications to support resilience for human and natural coastal communities.
- Goddard's Living Laboratory for Coastal Resilience
  - In NASA's largest shoreline protection program, sand is being added to Wallops beach to ensure ongoing protection of the agency's only launch range. Active climate adaptation science investigation (CASI) teams are providing science-based analysis and tools.

Goddard is now implementing the 2015 Sustainability Plan's strategies at all levels of management and operations, through five objectives:

1

Reduce energy consumption, associated air emissions, and other environmental impacts.

- 26% reduction in Goddard's energy consumption intensity from 2003 to 2015.
- 26% of square footage of Goddard's buildings is rated LEED Silver or better.

2

Manage water impacts including consumption, pollution, and climate change impacts.

- 25 tons of acid rain emissions producing sulfur oxides prevented each year by replacing fuel oil heat system at Wallops with clean-burning propane-based system.

3

Reduce waste through lifecycle materials management from source reduction and green purchasing to reuse and recycling.

- 23% of Goddard's energy obtained from renewable sources.
- 20,000 tons of carbon dioxide emissions prevented each year by using landfill gas in place of natural gas at Greenbelt.

4

Promote transportation alternatives to reduce environmental impacts and promote universal access to the center.

- Goddard is promoting a bike share program for employee use onsite and has made significant progress in transitioning fleet vehicles and other institutional support vehicles to hybrid or electric power.

5

Support local ecosystems by caring for the lands that support NASA operations.

- *Continued Preservation of Maritime Dune Woodland:* Planning of the North Wallops Island UAS runway prevented unnecessary impacts to the ecosystem of the rare habitat designated the North Wallops Island Conservation Site.
- *A Concerted Effort to Protect Wetlands:* Storm water management, drainage planning for construction, erosion mitigation practices and pollution prevention are in place to protect the habitat surrounding Wallops.
- *Shoreline Protection and Beach Nourishment:* Recovery activities undertaken in 2012 and immediately following Hurricane Sandy restored large areas of Wallops Island beach, creating over 150 acres of new beach habitat.

CELEBRATING 70 YEARS OF INNOVATION

WALLOPS FLIGHT FACILITY

EXTENDING NASA'S REACH FOR SCIENCE AND TECHNOLOGY

JUNE 1945 — First test rocket launched from Wallops to test its range assets.

JULY 1945 → 1948 — Tiamat is first research rocket launched. The program lasted until 1948 with nine more launches.

OCT 1954 — Launched the first U.S. four-stage rocket, the Nike-T40-T55 hypersonic heat-transfer vehicle.

OCT 1958 — NASA begins operations. National Advisory Committee for Aeronautics' Pilotless Aircraft Research Station becomes separate facility called Wallops Station, operating under NASA HQ.

1959 → 1961 — Project Mercury capsules were tested at Wallops in support of NASA's manned spaceflight program before astronauts were launched.

FEB 1961 — Explorer IX launches from Wallops, first payload launch into orbit.

MAR 1961 — Goddard Space Flight Center dedication.

MAR 1970 — During a total solar eclipse, a total of 32 sounding rockets were launched during a three-day period.

1974 — Wallops Station renamed Wallops Flight Center, expanded its horizons to include Earth studies of ocean processes and used its research airport for runway surface and aircraft noise reduction studies.

1945 · 1955 · 1965 · 1975

OUR LOYALTY

Goddard's strength is anchored in our proven capabilities, one-of-a-kind facilities, and our dedicated workforce. Goddard employs more than three thousand civil servants, over six thousand onsite contractors, and thousands of others (including off-site contractors, interns, and Emeritus) working in various technical and professional administrative positions. Goddard has a diverse and inclusive workforce that inspires creativity, collaboration, and innovation. At our core, we embrace inclusion that opens a broader view and seeks diversity of thought and perspective. We honor individuality, equality, and human dignity. We are committed to creating an environment that empowers us to be ourselves, contribute through our own experiences, thrive, and do our best work.

NASA's core values (safety, teamwork, integrity, and excellence) and key priorities are inherent in and embodied by the people who are leading the effort to achieve its mission. At Goddard, we recognize that our workforce is our greatest asset. Together, all facets of the diverse Goddard community are dedicated to the pursuit of the following objectives for the benefit of the agency and the public:

- Conduct NASA's missions while fully minimizing risk to life, property, communities, and the environment. Safety and environmental stewardship are vital to NASA's continued success.

- Meet our commitments to the agency and its customers by delivering high-quality products on time and on schedule. It is our

1981

Wallops Flight Center is merged into Goddard Space Flight Center and its name is changed to Wallops Flight Facility. It becomes NASA's primary facility for suborbital programs.

1983

The Balloon Program Office was established and has flown hundreds of balloons from locations around the world in support of scientific investigations.

1993

The Range Control Center currently used for missions like Antares and sounding rockets opened.

NOV 1996

Launched the first of several Pegasus XL vehicles beginning the High Energy Transient Experiment (HETE) program.

DEC 2006

U.S. Air Force Minotaur 1 rocket launched carrying the Air Force Research Laboratory's TacSat-2 satellite and NASA's GeneSat-1 microsatellite.

APRIL 2013

Inaugural Flight of Antares.

SEPT 2013

Lunar Atmosphere and Dust Environment Explorer (LADEE) satellite is the first lunar launch from Wallops.

JAN 2014

First official cargo resupply services flight of Antares/Cygnus.

2015 70TH

Seventy years of innovation. Open house draws thousands of visitors to celebrate historic milestone.

1985 1995 2005 2015

highest priority to uphold the agency's reputation of scientific distinction and reliability.

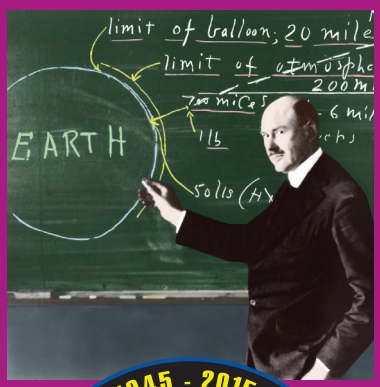
- Foster effective collaboration among individuals, teams, and management within the center, across NASA, and externally. Goddard's accomplishments result from these successful relationships as well as numerous strategic partnerships.

- Protect, support, and encourage employees by engaging, enabling, and empowering them in all of their efforts to safeguard the public trust. We maintain a world-class workforce dedicated to the execution of NASA's mission by:
  - Demonstrating confidence, fairness, honesty, and balance.
  - Providing opportunities for development and mobility.
  - Promoting diversity and inclusion.

- Ensure the success of our missions by supporting and sustaining employee dedication, agility, creativity, and commitment to excellence at all levels in the organization.

- Promote transparency and accountability by actively sharing our results and activities with customers, stakeholders, and the public, as well as engaging communities who are the ultimate beneficiaries of our work.

- Support NASA's other overarching approaches to finding new ways of doing business and investing in new technology.



ACROSS THE UNIVERSE

IN MEMORIAM

As we celebrate our collective achievements, we also honor all of those who have contributed to Goddard that are no longer with us.

Your dedication and talent will never be forgotten.

*Active civil servants who passed during 2015 include:

ANGELITA KELLY
PETER MEDLEY

‡Contractors, former civil servants, and others whose passing occurred or was reported during Sep. 2014 – Dec. 2015 include:

MARY ADKINS
AUGUSTIN (GUS) ALICEA
EARL ANGULO
VINCENT ARILLO
JOHN ARMIGER, JR
DAVID ATLAS
FAYE AUKERMAN
ALFRED BABECKI
JOSEPH BADEN
ZEB BARFIELD, SR
ROBERT BARNES
EVELYN BAUMANN
MOLLIE BERNATOWICZ
RONDA BISHOP
DANIEL BOWDEN
LOUISE BOZMAN
WILL BULLOCK
EMMETT BUNDICK
VALORIE BURR
MELVIN (MEL) CLARK
OLIVER CLARK
WILLIAM COLEMAN
THOMAS COLLINSON
BLANCHE CONNER
DONALD CONRAD
WARREN CROCKETT
MARSHALL CURTIS
RICKY DAUGHERTY
SEAN DAVIS
ANNE DAVIS
EDWARD DEVINE
ROBERT EAVES
EDWARD EISELE, JR
HOWARD ESTEP
DOUGLAS ESTES, JR
CHARLES FALKENHAN
ROBERT FARQUHAR
EDWARD FERN
THEODORE FERRARO
ORVILLE FLEMING, JR
DWIGHT FORTNA
HERBERT FULLER
INDALECIO GALICINAO
MICHELE (MICKEY) GARRETT
DONALD GIMPEL
HAROLD GOLDBERG
BETTY GROTON
KENNETH HALLAM
ROBERT HALLI, SR
RUDOLF HANEL
CAROLYN HANNA
BETTY JANE HAYDEN
RICHARD HICKS
OTTO HILDEBRAND
NOEL HINNERS
RUSSELL HOFFMAN
BARBARA HOLLAND
RICHARD HOLT
GEORGE HOPE
JACK HOWARD
DAN HUDSON
JANIE JOHNSON
WILLIAM JOHNSON
ALBERT KAMOSA
SAMUEL KELLER
LINDA LETELLIER
CHARLES LIPSETT
JOE LOPEZ
JAMES LYNCH
GEORGE MARECHEK, JR
SHERMIN MCCASLIN
LESLIE (LES) MEREDITH
DONALD MILLER
WILLIAM MISH, SR
GRAHAM MOORE
SEATON NORMAN
CARMEN PARSEN
BOB PATTERSON
VUK PERIC
WILLIAM POLAND, JR
LORREL POPP
HENRY PRICE, JR
ROBERT PRINCE
EARL QUIREY
WALTER RASKIN
RICHARD REEVES
HERBERT RICHARD
WILLIAM RICHARDSON
BURREE RICHARDSON
MICHAEL ROBERTO, JR
ANDREW ROLINSKI
NANCY MENGEL ROSENSWEIG
KAREN SHANNON
CLIFFORD SHORTER
MILTON SING
ROGER SMITH
DEAN SMITH
GEORGE STITT
ROBERT SULLIVAN
HELEN THAYER
OTTO THIELE
ROGER THOMAS
MARJORIE TOWNSEND
JOHN TRESANSKY
JAMES VETTE
JOHN VOLPE
CARL WAGENFUEHRER
KEN WATHAL
H. JOHN WOOD III
RICHARD WRIGHT

*NOTE: NASA does not have access to this information for former NASA civil servants. The report authors have been informally notified of such individuals who have been added to the list under contractors and others.

‡NASA does not have access to this data for contractors and others affiliated with Goddard. An earnest attempt was made to manually collect this information. However, the nature of the process could result in the list being incomplete.

Please email omissions to Shanessa Jackson (shanessa@nasa.gov) and copy Mary Pat Hrybyk-Keith (mary.p.hrybyk-keith@nasa.gov) and Peter Hughes (peter.m.hughes@nasa.gov). The electronic version of this report will be updated accordingly. Updated 2.3.2016.

Goddard
SPACE FLIGHT CENTER

There can be no thought of finishing—for aiming at the stars, both literally and figuratively, is the work of generations—but no matter how much progress one makes, there is always the thrill of just beginning.

– Robert H. Goddard

For more information, please visit our web site:
www.nasa.gov/goddard

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